Electrical World

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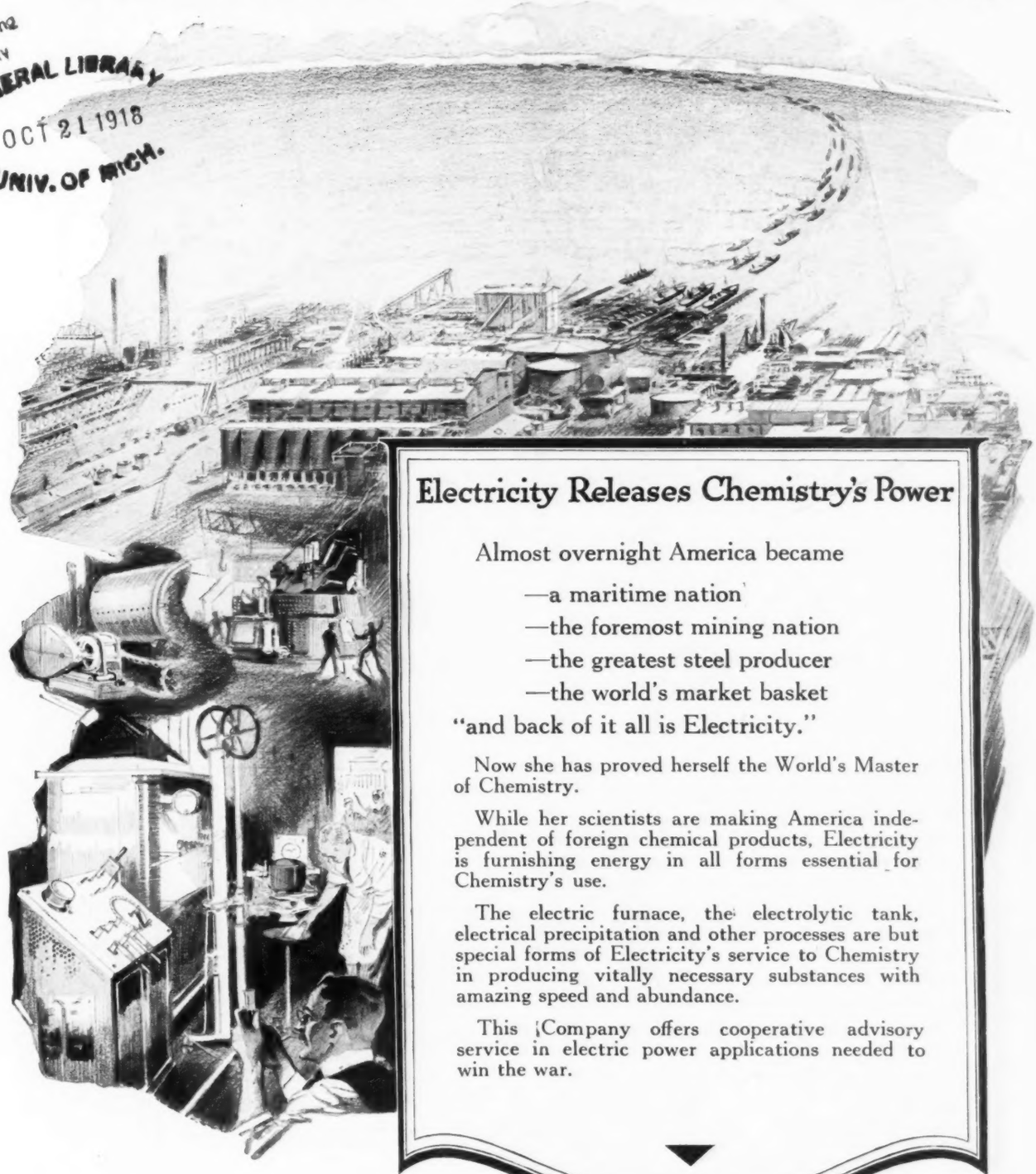

Electricity Releases Chemistry's Power

Almost overnight America became

—a maritime nation
—the foremost mining nation
—the greatest steel producer
—the world's market basket

"and back of it all is Electricity."

Now she has proved herself the World's Master of Chemistry.

While her scientists are making America independent of foreign chemical products, Electricity is furnishing energy in all forms essential for Chemistry's use.

The electric furnace, the electrolytic tank, electrical precipitation and other processes are but special forms of Electricity's service to Chemistry in producing vitally necessary substances with amazing speed and abundance.

This Company offers cooperative advisory service in electric power applications needed to win the war.

GENERAL ELECTRIC COMPANY

GENERAL OFFICE SCHENECTADY, N.Y.

Weston

Electrical Indicating Instruments

are unqualifiedly superior to any other instruments designed for the same service.

A. C. or D. C., Switchboard or Portable Instruments for every field of Indicating Electrical Measurement. In writing for catalogs and bulletins please specify the field that interests you.

Weston Electrical Instrument Co.

13 Weston Ave., Newark, N. J.

23 Branch Offices in the Larger Cities

Vol. 72, No. 16 New York, October 19, 1918 *Pages 729-776*

Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

Member Audit Bureau of Circulations, Member Associated Business Papers, Inc.

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JAMES H. McGRAW, *President* ARTHUR J. BALDWIN, *Vice-President* E. J. MEHREN, *Vice-President* EDWARD CALDWELL, *Treasurer* JAMES H. McGRAW, JR., *Secretary*

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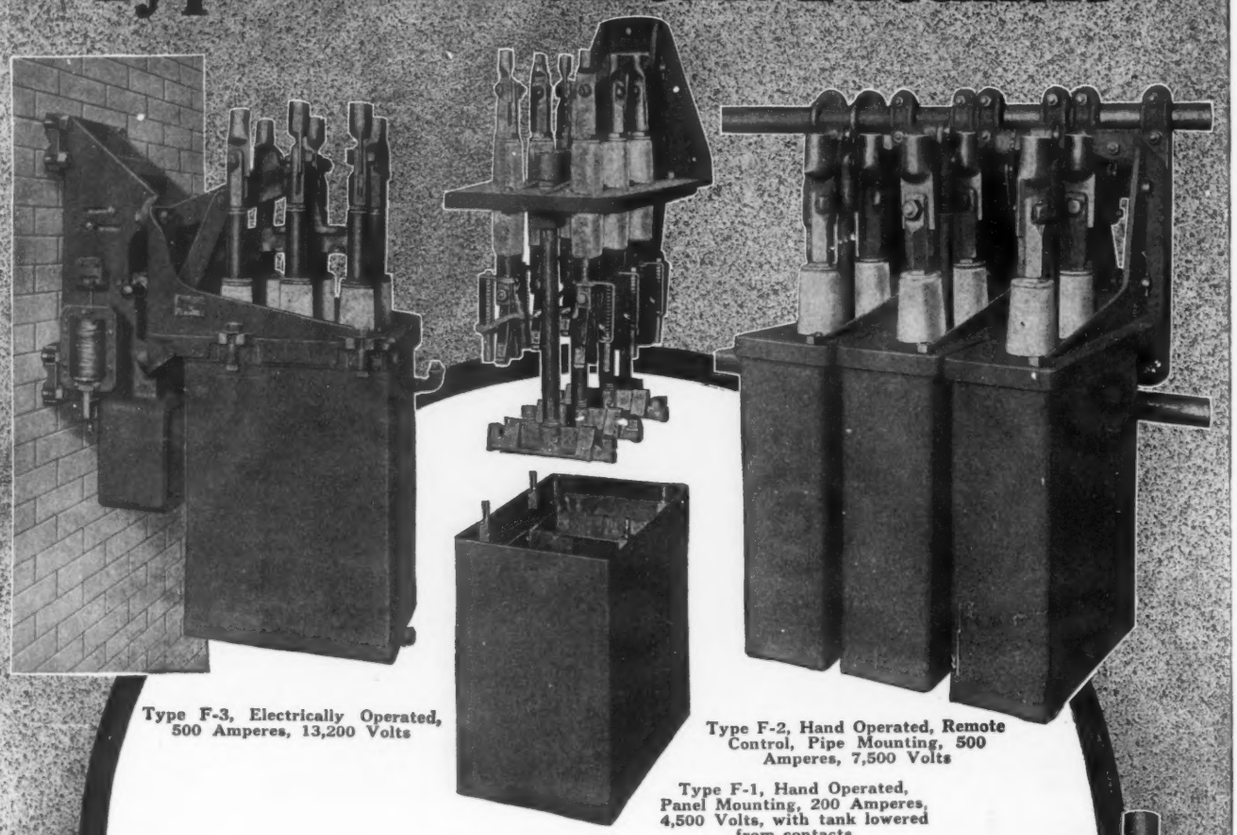
Circulation of this issue 18,000 copies

Type F Oil Circuit Breakers



Type F-3, Electrically Operated, 500 Amperes, 13,200 Volts

Type F-2, Hand Operated, Remote Control, Pipe Mounting, 500 Amperes, 7,500 Volts

Type F-1, Hand Operated, Panel Mounting, 200 Amperes, 4,500 Volts, with tank lowered from contacts

A large part of the prestige of these breakers is due to tne finger type of the stationary contact used.

The fingers are flexibly mounted, therefore self-aligning, but exert high contact pressure through a separate stiff steel spring. Initial contact pressure is obtained by keeping the fingers separated under pressure by a stop. This follows out the well-known idea of the controller finger.

The fingers are protected from all arcing by a separate, spring-operated, butt-type arcing tip.

Catalogue Section 261 gives particulars.

Westinghouse Electric & Manufacturing Company

East Pittsburgh, Pa.

Sales Offices in All Large American Cities

W WESTINGHOUSE ELECTRIC

Type F Stationery Contact, Pillar Type 300 Ampere, 7500 Volt

Westinghouse

A Successful Ambassador

The Westinghouse Waterwheel Generator

is appreciated not alone in America; it is equally successful in Asia, in Africa, in South America.

Satisfaction with one Westinghouse product leads to the trial of others.

Proved designs, high-grade materials, and skillful workmanship insure Westinghouse Waterwheel Generator success at home and abroad.

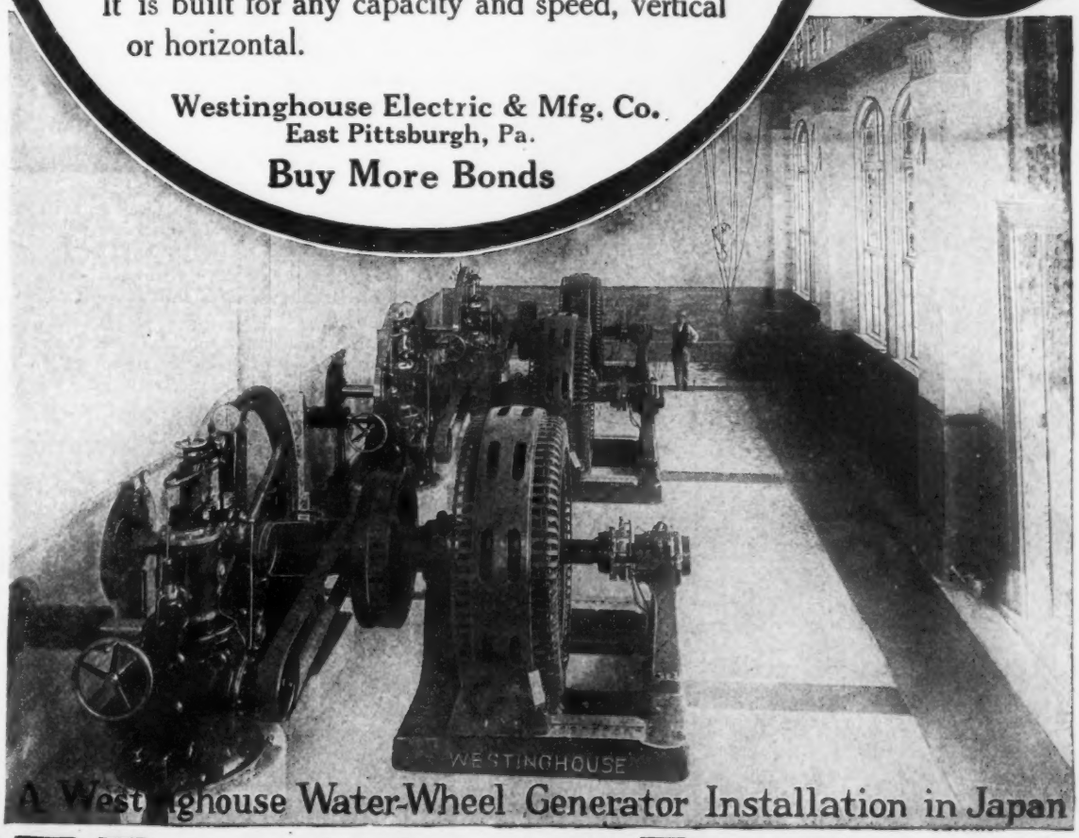
It is built for any capacity and speed, vertical or horizontal.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Buy More Bonds

Our relations with our fellowmen become closer as our interests merge.

W
WESTINGHOUSE ELECTRIC



A Westinghouse Water-Wheel Generator Installation in Japan

Westinghouse

Turning Lamp Prospects Into Customers

Sowing the Seeds

When you mail a printed announcement, folder or booklet to a customer or a prospect, you are doing the first necessary thing toward making your business grow—

Provided, of course, what you mail is of appropriate character, and is carefully and attractively gotten up.

Distributors of WESTINGHOUSE MAZDA LAMPS are exceptionally well provided for in this respect. The WESTINGHOUSE MAZDA ADVERTISING SERVICE furnishes them with a constant supply of new and effective advertising material of the real sales-building kind.

It is producing excellent results for distributors who are using it consistently and intelligently.

The October-November portfolio of sales helps and advertising material has already been sent out. If you have not received this campaign-layout, send for it now.

Westinghouse Lamp Company
165 Broadway, New York

Sales Offices and Warehouses throughout the country. For Canada—Canadian Westinghouse Co., Limited, Hamilton, Ont.

W TINGHOUSE MAZDA ADV ISING SERVICE

TRADE MARK

Oiled Paper Varnished Cambric Oiled Silk

Black and Yellow Varnished Tubing

Electrical Machine, Cable and Magneto manufacturers use IRVINGTON INSULATION when building new equipment. Electric Transportation Systems use IRVINGTON INSULATION.

Specify IRVINGTON INSULATION when making all repairs.

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey.

Inside Potheads

Form "N," Shape "D" Pothead

Form "N," Shape "U" Pothead

Form "N," Shape "W" Pothead

Form "N," Shape "Z" Pothead

G & W Makes Everything In Potheads!

CONSIDER G & W *headquarters* for *any* Pothead requirements you may have. For over 14 years G & W engineers have *specialized* on the design and manufacture of Distribution Specialties for overhead, underground, outside and inside service. It is our engineering policy to build every G & W product to fulfill a certain definite purpose; which is another way of saying that the *right* device for a given application may be obtained without resorting to "makeshifts" or misfits that usually result in unsatisfactory service or unnecessary inconvenience. The inside Potheads illustrated herewith comprise but a portion of our complete line. In addition to Potheads (detachable and non-detachable, inside and outside types) the G & W line includes:

Switching Boxes
Distribution Boxes
Subway Cutouts
Low Tension Tap Boxes
Street Pillar Boxes
Cast Iron Splice Boxes
Safety Line-Disconnectors
Ground-Pipe Caps
Series Cutouts
Schweitzer High Potential Detectors
Oil-Submerged Compression Cutouts
Miscellaneous Insulation Specialties

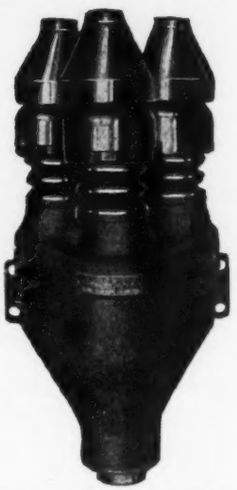
Write for the new G & W Catalog No. 10

G & W Electric Specialties Co.

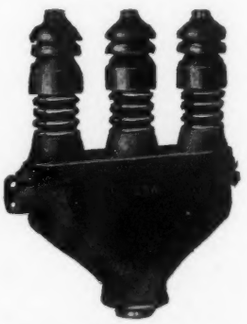
Manufacturers of Potheads, detachable and nondetachable; Switching and Distribution Boxes; Overhead and Underground Distribution Specialties

7440 South Chicago Ave., Chicago

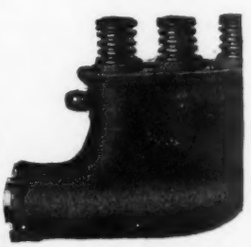
Sales Representatives: Birmingham, Ala. McClary-Jemison Machinery Co. Calgary, Alberta, General Supplies, Ltd., 122 W. 11th St. Boston, Mass., Robt. H. Anthony, 261 Franklin St. Los Angeles, Cal., Chas. Farnham, 207 I. W. Hellman Bldg. Minneapolis, Minn., White & Converse. New York City, N. Y., Lewis & Roth Co., 13th & Wood Sts. Philadelphia, Pa., Lewis & Roth Co., 1012 Liberty Bldg. Rochester, N. Y., Henry J. Schiefer, San Francisco, Cal., Electric Material Co., 589 Howard St. Seattle, Wash., W. R. Hendrey & Co., Hoge Bldg. St. Paul, Minn., White & Converse. Toronto, Ont., A. H. Winter Joyner, Ltd., 100 Wellington St., W.



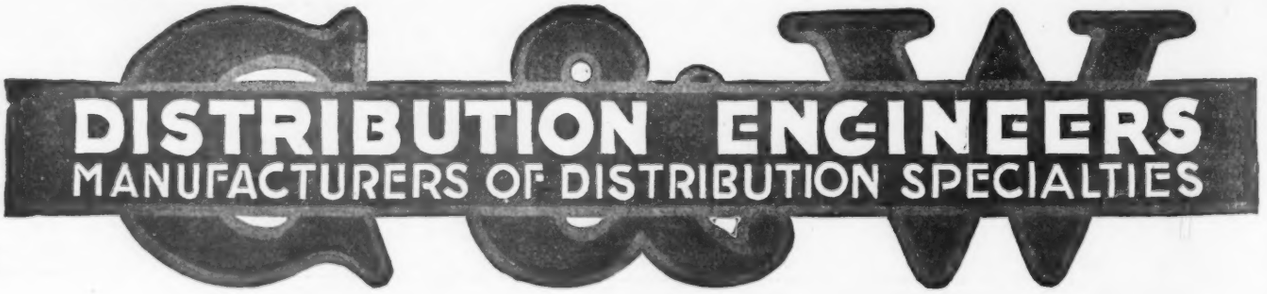
Type "M T S," Three-conductor, 12,000 Volts inside service, 6,600 volts outside service.



Type "Ms" or "M O," 3 Conductor, for 10,000 Volts.



Form "N," Shape "K," Left-hand entrance



Western Electric Company

INCORPORATED

New York	Philadelphia	Atlanta	St. Louis	Kansas City	Chicago	Denver	San Francisco
Newark	Baltimore	Richmond	Memphis	Minneapolis	Detroit	Salt Lake City	Oakland
Boston	Syracuse	Birmingham	New Orleans	St. Paul	Cleveland	Spokane	Los Angeles
New Haven	Buffalo	Charlotte	Dallas	Duluth	Indianapolis	Omaha	Seattle
Providence	Pittsburgh	Savannah	Houston	Milwaukee	Cincinnati	Oklahoma City	Portland

EQUIPMENT FOR EVERY ELECTRICAL NEED

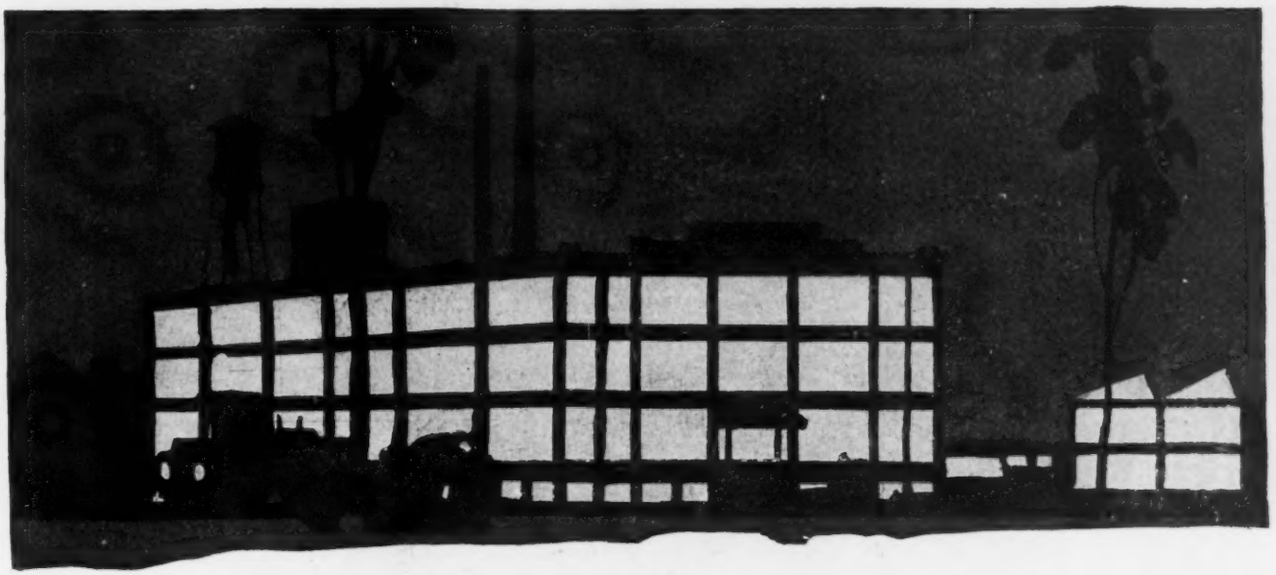
Modern Lighting Only 5 Years Old

The NATIONAL MAZDA C lamp in 1913 was a brand new kind of light source. No incandescent lamp had ever exhibited so intense a brilliancy with so small a consumption of current. This so reduced the cost of lighting that even the smallest industrial plant could now afford genuine illumination. But, at the same time, it demanded a big change in lighting practice. A new phase of illuminating engineering has since developed which has made obsolete the best lighting obtainable only five years ago.

The RLM Standard

The R L M Standard dome reflector embodies specifications drawn up jointly by the makers of reflectors and the engineers of the Mazda lamp manufacturers. All reflectors that conform to these specifications bear the R L M trade mark label. It insures satisfactory lighting results.

National



Give the Night Shift An Even Chance

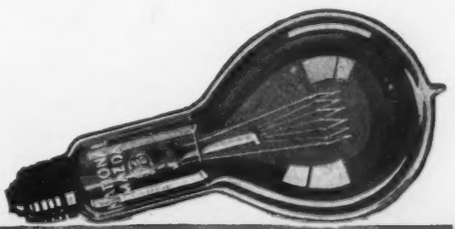
Greater production was never more urgent than now. It is vitally so. Industrial activities being continuous 24 hours a day in a great bulk of the nation's plants, immediate attention must be given to after dark illumination.

Provide the night worker with an ample supply of glareless, diffused and properly distributed light and you start him off with a chance to equal the day worker's rate of output. Yet in how many plants do you find this level of efficiency maintained? The percentage is astonishingly low.

Investigate the lighting conditions in your own shops. See them first hand by going through your plant when the night shift is in full swing. But do not stop there. There is undoubtedly a local lighting man who will be glad to give you the benefit of his experience. If not, our engineers will aid.

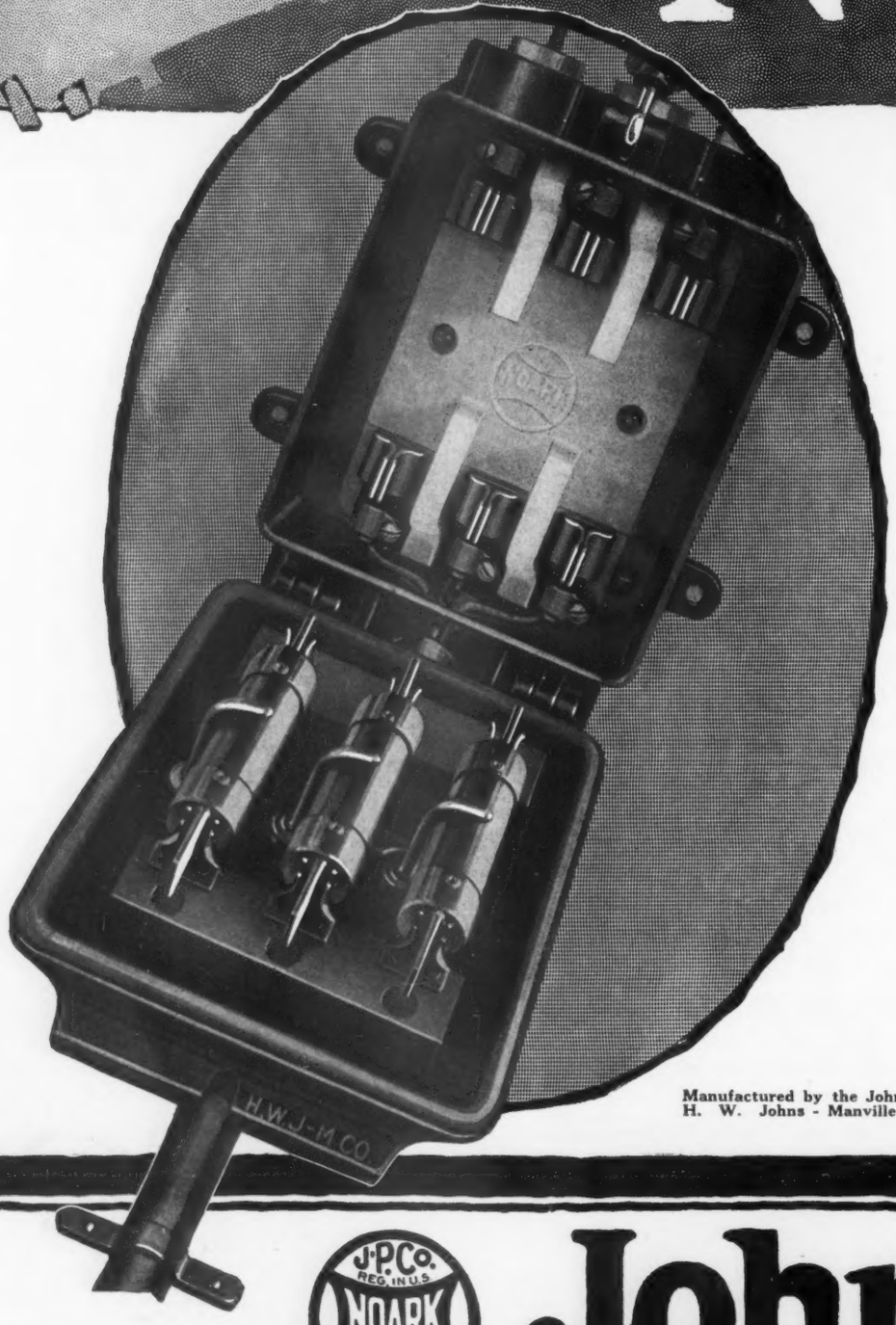
NATIONAL LAMP WORKS of General Electric Co., Nela Park, Cleveland, O.

Any of the labels below is a guaranty of National Quality



MAZDA

NO



Manufactured by the Johns-Pratt Co., Hartford, Conn.
H. W. Johns - Manville Co., Sole Selling Agents

J-P-Co. REG. IN U.S. NOARK PAT. OFF. FUSE

Johns-
ELECTRICAL

The Value of This Service Box

Economy—It eliminates the fused knife entrance switch in installation, by combining it with the cut-out device,—saving both installation space and expense; and permitting the optional pulling of fuses when the lid is opened.

Quality—No better argument for quality has ever been made than the silent staying power of the good materials used in its construction.

Safety—The urgent necessity for properly safeguarding present electrical equipment has vindicated the judgment of central stations that selected

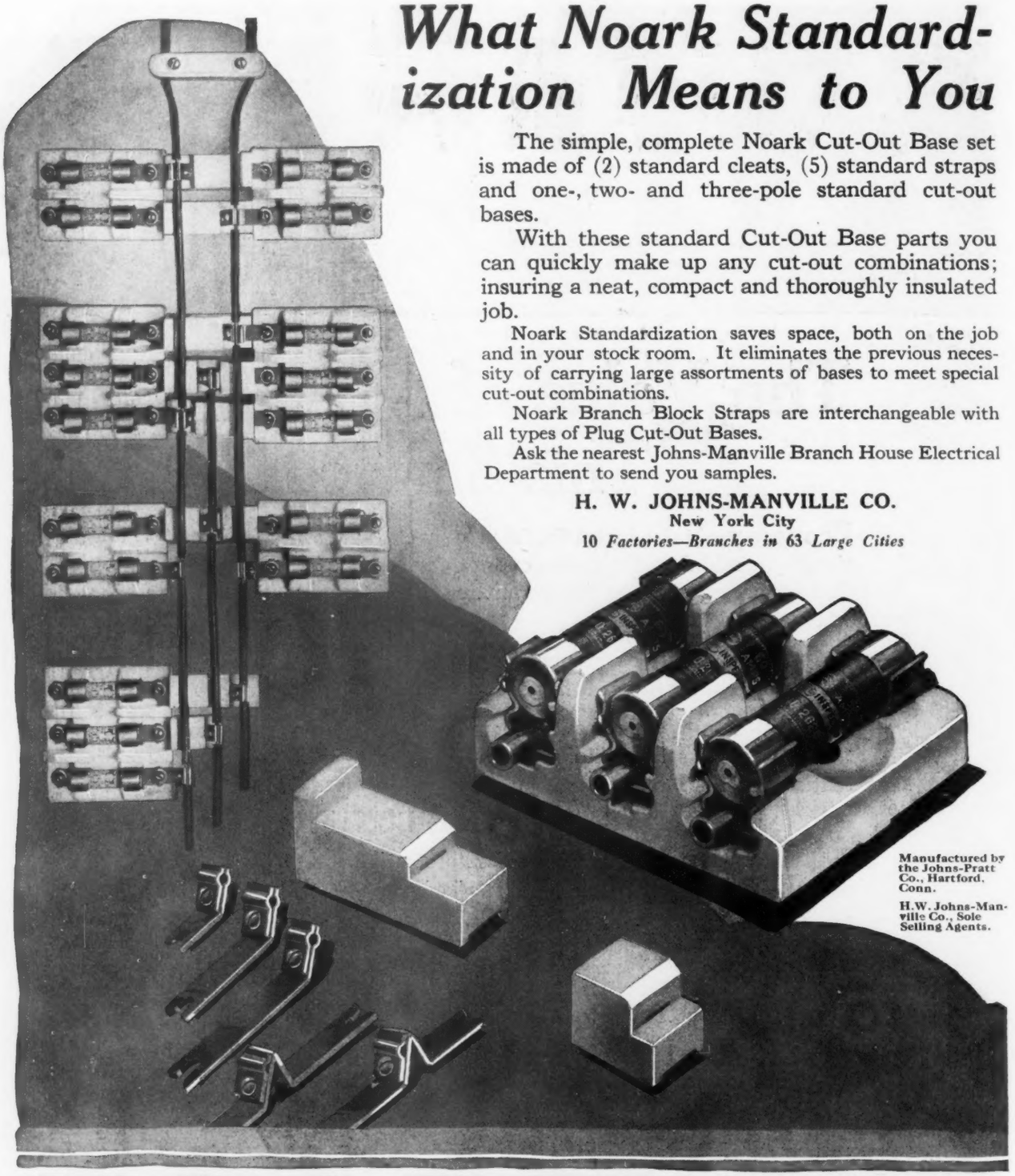
NOARK SERVICE BOXES

—as the most economical and safest protection for their consumer service.

It will pay you to get in touch with the nearest Johns-Manville Branch House Electrical Department—it will gladly give you complete information—and further proof of the reliability of the Noark Service Box.

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 63 Large Cities

Manville
DEVICES



What Noark Standardization Means to You

The simple, complete Noark Cut-Out Base set is made of (2) standard cleats, (5) standard straps and one-, two- and three-pole standard cut-out bases.

With these standard Cut-Out Base parts you can quickly make up any cut-out combinations; insuring a neat, compact and thoroughly insulated job.

Noark Standardization saves space, both on the job and in your stock room. It eliminates the previous necessity of carrying large assortments of bases to meet special cut-out combinations.

Noark Branch Block Straps are interchangeable with all types of Plug Cut-Out Bases.

Ask the nearest Johns-Manville Branch House Electrical Department to send you samples.

H. W. JOHNS-MANVILLE CO.
New York City
10 *Factories—Branches in* 63 *Large Cities*

Manufactured by the Johns-Pratt Co., Hartford, Conn.

H.W. Johns-Manville Co., Sole Selling Agents.

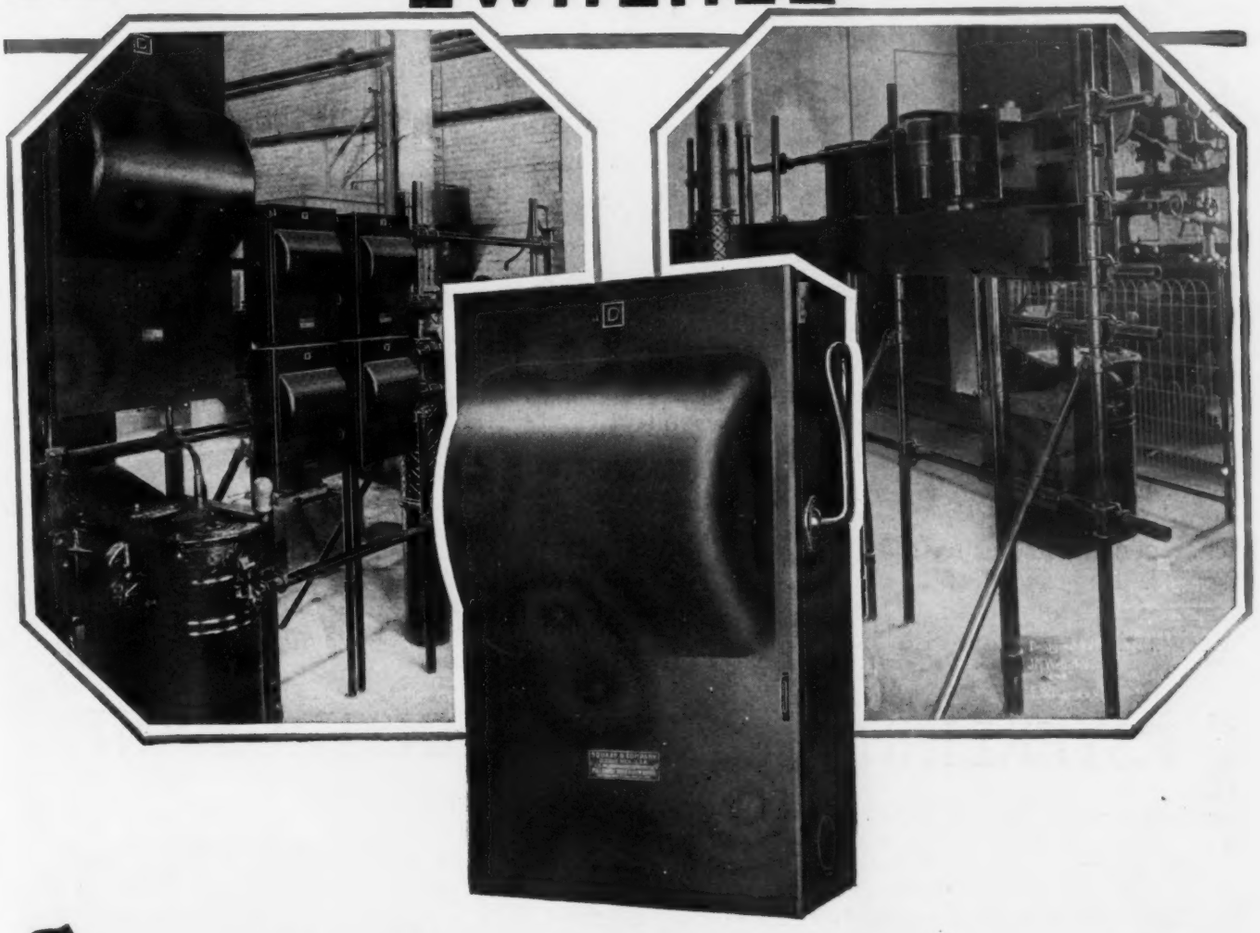
NOARK CUTOUT BASES

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE

J-P Co. REG. IN U.S. NOARK PAT. OFF FUSE

SQUARE D
SWITCHES



Sensible Switchboard Construction

"FRILLS" in switchboard building have given way to a new departure which satisfies all conditions and compels safety. Note the two illustrations of a truly *sensible* switchboard constructed of material obtainable locally—made of pipe and fittings to conform to any available space—easily added to to meet the requirements of expansion. No marble or slate panels are required, no expensive bus-bars. The adaptability of Square D Switches makes this construction practical; the steel enclosure, lock-off device and external operation make it safe.

THE ORIGINAL SAFETY SWITCH

SQUARE D COMPANY, Detroit, Mich.
Canadian Factory, Walkerville, Ont.

SQUARE D SWITCHES
do not hinder production

This is No. 2 of a series of advertisements descriptive of new and exclusive advantages of Esterline Indicating Meters. Follow the entire series; No. 3 will appear in an early issue of Electrical World.

Ruggedly Built!

to Withstand Rough Usage

—ESTERLINE INDICATING METERS

(Type "W" Duplex Portables)

Particularly noticeable throughout this new Esterline *Indicating* Instrument line, is the substantial construction of every part. Without impairment to other desirable features such as light weight, compactness and responsive movement alertness, Esterline Engineers have made these Duplex Type W Portables amply strong to resist the knockabout existence such instruments must live, and "then some". For example: The entire moving element is assembled in the case on specially designed aluminum alloy castings insuring rigidity and permanent perfect alignment of all parts. Here is the ideal combination of high, sustained accuracy, general utility, and the ruggedness required for "trouble shooting," transformer bank testing, motor testing, etc. Combined with the exclusive *utility* feature of "two-instruments-in-one-case," the advantages of this new Esterline dependable product are being quickly accepted by engineers and operating men everywhere. Bulletin No. 386-W contains complete description. Write for your copy *today*.

ESTERLINE INDICATING INSTRUMENTS

are known as our Type W *Duplex* line because of their "two instrument-in-one" feature, enabling any one of the following combinations to be secured in one instrument: Voltmeter and Ammeter; Single Phase Wattmeter and Voltmeter; Single Phase Wattmeter and Ammeter; Two-Range Voltmeter combined with either an Ammeter or Single Phase Wattmeter; and Polyphase Wattmeter.

In addition they embody other important advantages as follows:

Moving element carried on a steel suspension wire, many times stronger than necessary to carry the weight imposed, and thereby preventing damage from vibration or sudden shocks.

Fully enclosed non-spillable damping chamber in bottom of frame, with filling tube readily accessible for replenishing damping fluid supply. Construction is such that any desired degree of damping may be secured.

All instruments equipped with zero adjusting device operated by thumb-screw on top of instrument.

Two instruments combined in one mean: lighter weight, compactness, convenience. Total weight of instrument is only ten pounds.

The ESTERLINE Co.

Pioneers in the Manufacture of Curve Drawing Instruments

Indianapolis, Ind., U. S. A.

Branch Offices in All Principal Cities

O-B PRODUCTS

Quality First

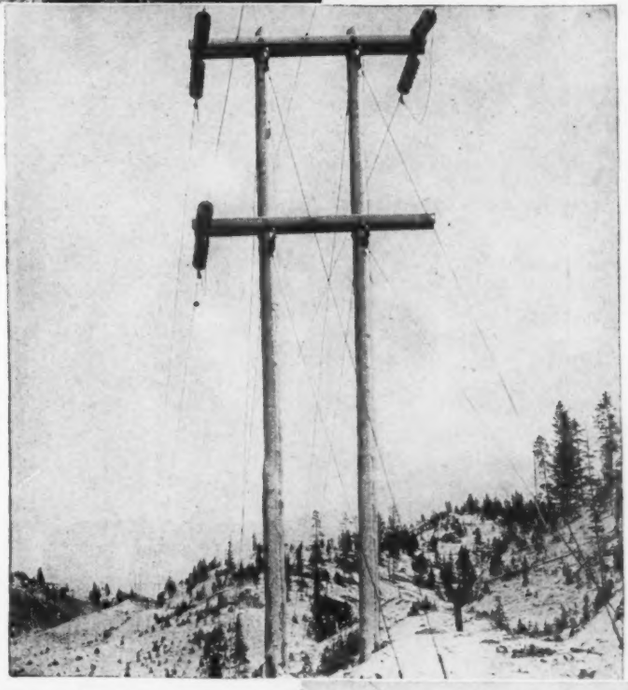
War-Time Transportation

Water power has replaced fuel on the hardest length—440 miles over three mountain ranges—of the Chicago, Milwaukee & St. Paul.

Besides this enormous saving the transportation of the fuel is eliminated.

And the electric locomotives handle bigger loads more swiftly and smoothly than the largest of the steam predecessors.

Other electrified roads are making savings and speeding up the same way.



And War-Time Insulators

On the C., M. & St. P., as well as on numerous other electriffications, O-B Insulators are protecting the power supply.

Reliability is the prime requisite of the transmission line. Reliability is the chief characteristic of O-B *MODERNIZED INSULATORS*.

Designs for every condition in the station and on the line.

THE OHIO BRASS COMPANY
Mansfield, Ohio

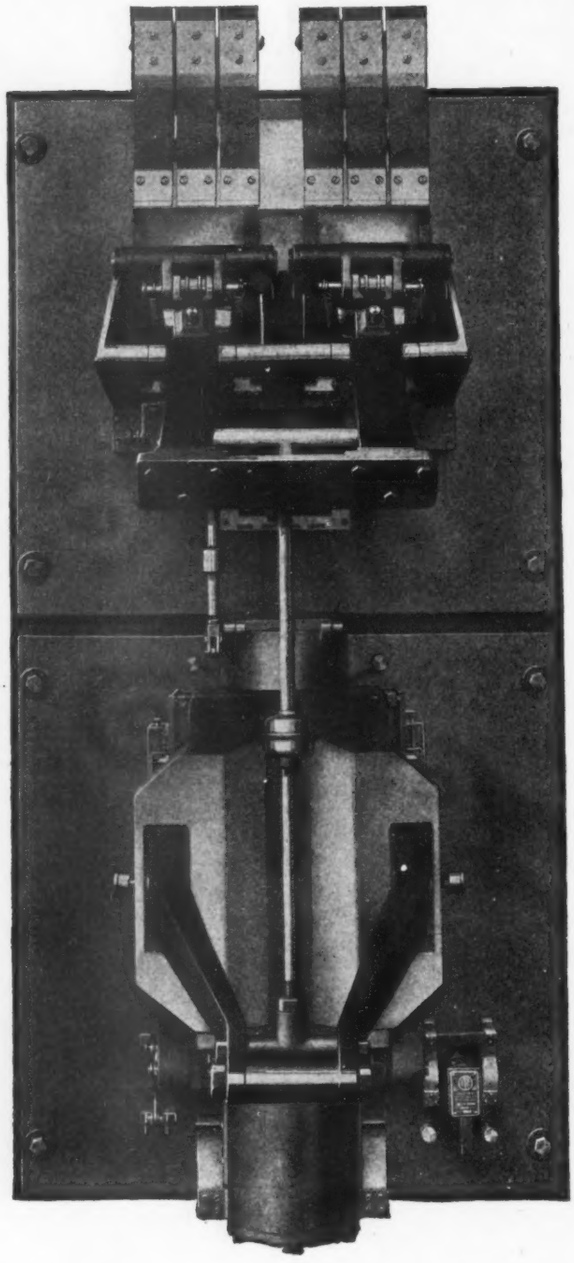
I-T-E Circuit Breaker

THE chief characteristics in I-T-E Circuit Breaker design are simplicity, strength, reliability and accuracy.

That our apparatus embodies these essentials is proven by the vast number and great importance of our installations.

Within the past year we have been called upon to do the almost impossible, and we have done it.

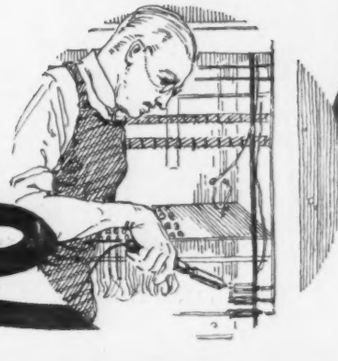
Ask Uncle Sam—
He Knows



SINGLE Pole Circuit Breaker of 15,000 amperes capacity, Remote Control, Solenoid Operated with Direct Acting Overload Feature. Used for the protection of a rotary. In this case, owing to the peculiar local conditions, the Reverse Current Feature, which is usually desirable, was omitted. The illustration clearly indicates the simplicity and ruggedness of this form of apparatus. The relay in the lower right-hand corner is used for localizing the closing coil circuit, thus enabling the use of control wires of minimum size.

THE CUTTER COMPANY, PHILADELPHIA

6 Uses of the C-H Soldering Iron



FOR biscuit and cracker boxes—for soup, vegetable, varnish and paint cans—for the telephone switchboard—for a thousand and one jobs in scores of industries—the rugged, long-service C-H Iron is daily helping to speed along essential work.

As an electrical man, have you brought this efficient tool before the factory and industrial production man? Have you pointed out that now in these strenuous times, the cleanliness—lack of odor—saving in steps—reduced fire hazard, make it almost unpatriotic to not investigate the possibilities of the electric soldering iron. And there is good business business in it for you, too.

In C-H Irons the heater core *extends right up into the tip*—and the coil is *hermetically sealed.* No flux or moisture can enter.

Publication No. 253 is yours for the asking.

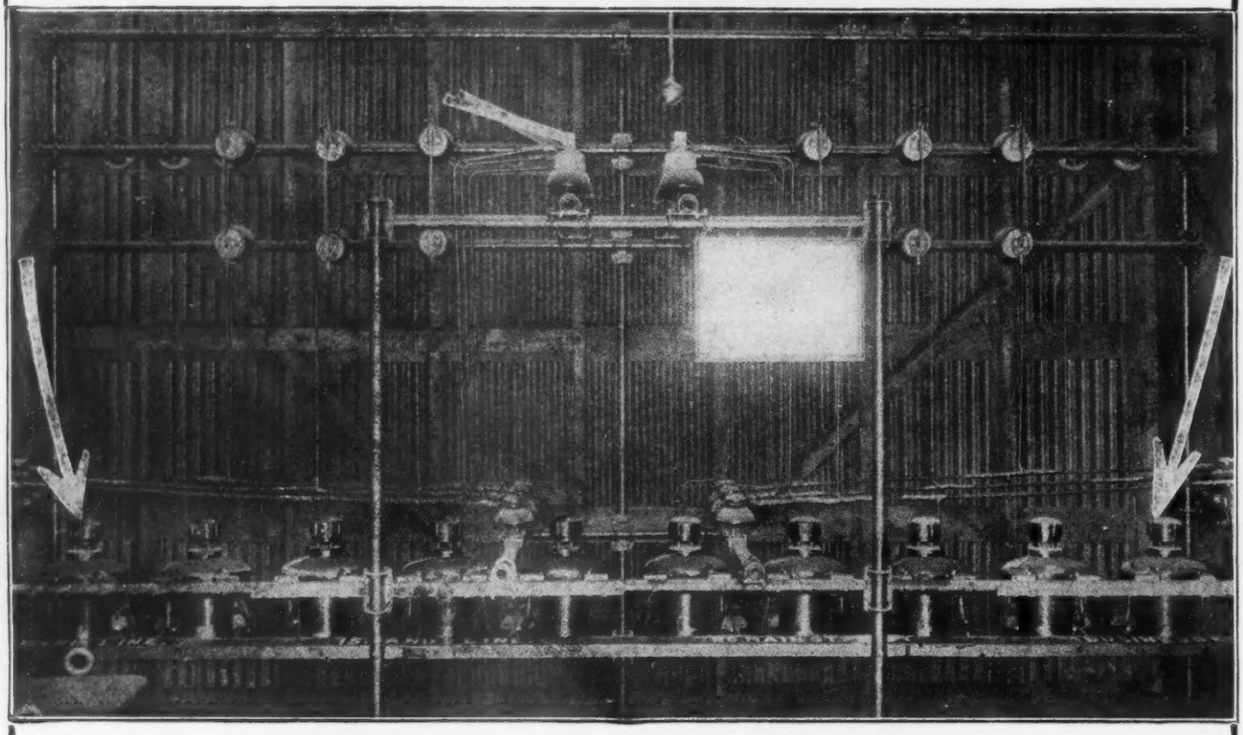
Have you seen the new Automatic Rack for holding soldering irons?

The Cutler-Hammer Mfg. Co., Milwaukee and New York

Other Electrically Heated Products are:

Air Heaters; Plate Warmers and Ovens; Space Heaters; Laundry and Tailors' Irons; Immersion Heaters; Hatters Appliances; Vat Dryers; Linotype Metal Pot Heaters; Chocolate Warmers and Batch Warmers for Candy Factories; Waters Heaters; Heaters for packaging and sealing machines, for rubber and celluloid molds, for printing and embossing press blocks, matrix tables, paper rolls, ironing rolls, etc.

"GUARDIANS OF THE LINE"



"PERFECT PROTECTION"

is the indorsement given by the Utah Power and Light Co., of Logan, Utah, after 2½ Years with

"D & W" OIL FUSE CUT-OUTS

"GUARDIANS OF THE LINE"

THREE LINES IN FROM THE PLANT AT 4000 V.
FOUR LINES OUT TO BRANCHES AT 4000 V.

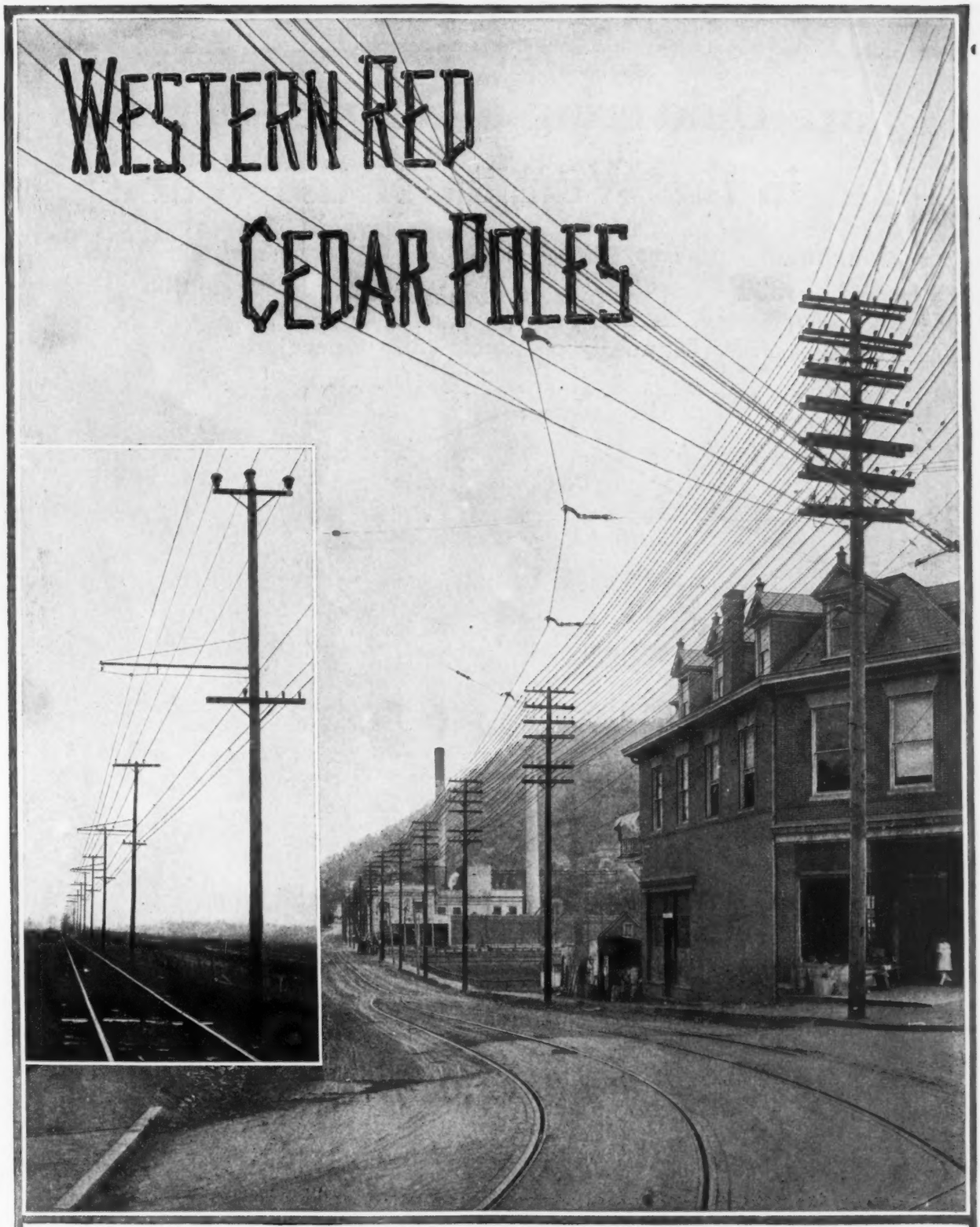
POLE LINE TYPE

The use of these cut-outs is now standard practice in many of the leading Central Stations of the country and are rapidly being mustered for Universal Service.

SEND FOR CATALOG NO. 2.

D & W Fuse Company

Providence, Rhode Island



Western Red Cedar Poles at Roanoke, Va.

The line of poles in the main picture is located at Roanoke, Va. These *Western Red Cedar Poles* which were set only a few months ago are 55 foot and 60 foot long. They carry directly from the power station both the 500-volt feeders of the railway and the 2300-volt primaries of the light and power department. For part of the way also they carry the company's private telephone wire. The sightliness and strength of these poles are a source of satisfaction now. Their durability will be a source of satisfaction for many years to come.

ALSO IN INDIANA

The small view shows a line of strong, straight, sightly, *Western Red Cedar Poles* doing good service along the right-of-way of the Fort Wayne & Northern Indiana Traction Company of Fort Wayne, Indiana. *Western Red Cedar Poles* are rendering highly satisfactory service in all parts of the country.

WESTERN RED CEDAR ASSOCIATION, Spokane, Wash.

CONDIT Oil Switches and Circuit Breakers are Delivering a Definite Service in the Winning of the War

Maximum Amperes 300 — **Type D-16 Outdoor** — **Maximum Volts 44,000**

Manually or Electrically Operated

Specifications—A.C., 60-cycle triple pole, single throw, full automatic form, plain overload, relay trip, multiple single pole, outdoor floor mounting, electrically operated, remote control.

Plants engaged in essential production have our best attention, and our engineering department is at their disposal. Type D-16 oil circuit breaker is designed for outdoor service and requires no additional shelter. It may be mounted on a pipe framework which allows for the easy removal of the oil tanks with the help of a tank lifting device.

Also Made for Indoor Service—Type D15

Condit Electrical Mfg. Company, South Boston, Mass.

Manufacturers of Electrical Protective Devices

Akron, Ohio, 323 Ohio Bldg.
Albany, N. Y., 124 Hudson Ave
Birmingham, Ala., Brown-Marx Bldg.
Buffalo, 604 Electric Bldg.
Charlotte, N. C., Commercial Bank Bldg.
Chicago, 19 So. Wells St.
Cincinnati, 1309-10 Union Trust Bldg.
Cleveland, 1202 Illuminating Bldg.
Dallas, 408 So. Ervay St.
Denver, 1621 Seventeenth St.
Detroit, 617 Ford Bldg.
Kansas City, Mo., Interstate Bldg.
Los Angeles, San Fernando Bldg.
Miami, Fla., 329 Thirteenth St.
Minneapolis, 716 McKnight Bldg.
New Orleans, 821 Union St.
New York City, 39 Cortlandt St
Philadelphia, 929 Chestnut St.
Pittsburgh, 706 May Bldg.
Salt Lake City, 218 Judge Bldg.
San Francisco, 583 Howard St.
Seattle, 552 First Ave. S.
St. Louis, La Salle Bldg.
Washington, D. C., Conduit Rd. & Elliott St., N. W.

Northern Electric Company LIMITED

Montreal Winnipeg Halifax Regina Ottawa Calgary Toronto Vancouver London, Ont.

CONDIT: *the Synonym of Safety in Electrical Protective Equipment*

E. S. B. Co. Batteries

are batteries with an ancestry—an ancestry that extends back over thirty years of successful battery building—an ancestry that goes right to the beginning of practical storage battery manufacture in America.

Every E. S. B. Co. battery is built on the solid basis of "proved worth."

Batteries Manufactured by This Company Are Used

By Central Lighting and Power Companies.
For small Isolated Lighting and Power Plants.
By Telephone and Telegraph Companies and for Wireless.
For Mining Locomotives, Railway Car Lighting, Switch and Signal Service, Battery Street Cars, etc.
For Electric Pleasure and Commercial Vehicles.
For Industrial Trucks and Tractors.
For Automobile Starting and Lighting.

Our nearest sales office will send you practical bulletins on request.

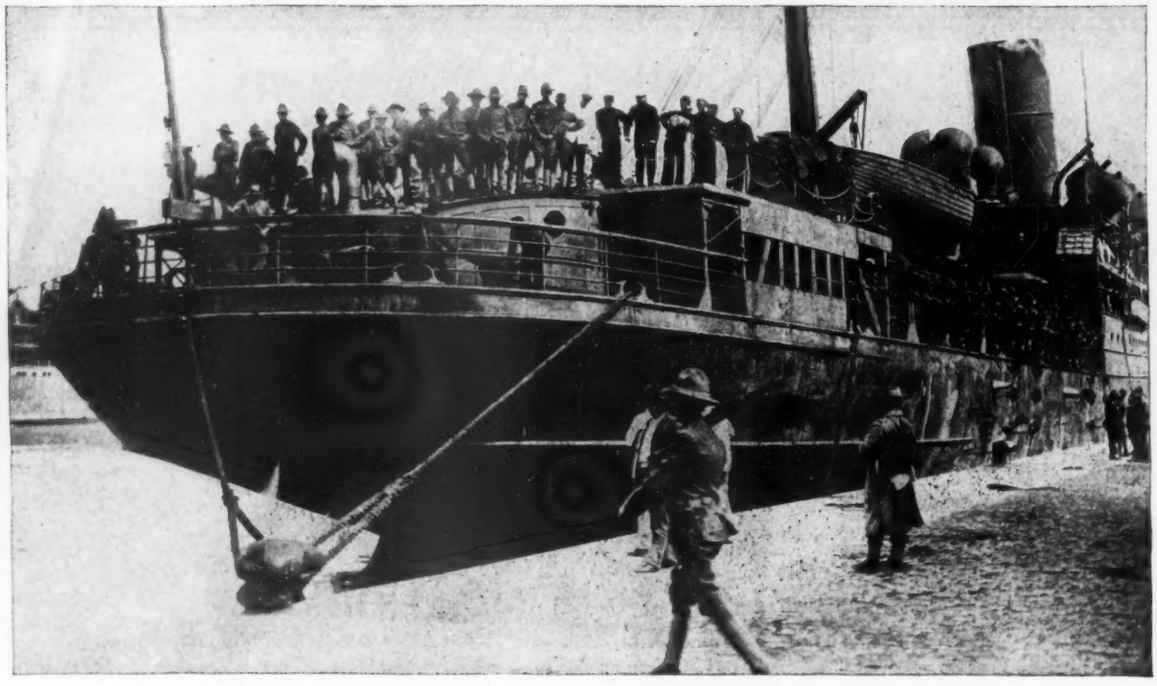
THE ELECTRIC STORAGE BATTERY CO.

The oldest and largest manufacturer of storage batteries in America

1888 PHILADELPHIA, PA. 1918

New York	Boston	Chicago	Washington
Denver	San Francisco	St. Louis	Minneapolis
Cleveland	Atlanta	Kansas City	Pittsburgh
Detroit		Rochester	Toronto

"Exide", "Hycap-Exide", "Ironclad-Exide", "Thin-Exide"
"Chloride Accumulator", "Tudor Accumulator"



OUR ARMY ABROAD can't fight its way to Berlin without the help of our army at home. Our factories *here* must operate at their utmost capacity to keep our armies *there* supplied with the necessities of war.

To assure continuous operation of all electrical equipment your circuits must be properly fused. Leading firms in practically all lines of important industry have adopted "UNION" Fuses, after exhaustive comparative tests.

These firms "FUSE THEIR CIRCUITS THE UNION WAY" because their tests showed them that by so doing they would remove all element of chance—they would be sure of the right fuse for each circuit—they would secure maximum efficiency at minimum cost.

"UNION" Fuses are the result of our thirty years of experience, thirty years devoted to the study and manufacture of fuses.

Unless you are *sure* that *your* circuits are *properly fused*. write or wire for one of our Fuse Engineers. He will call on you promptly, inspect your circuits, and suggest such changes as in his opinion are desirable.

This engineering service will cost you nothing and may profit you considerably. Don't delay. Write or wire today.

"UNION" Fuses, both renewable and non-renewable are sold by dealers in electrical supplies throughout the country.

Chicago Fuse Mfg Co.

Renewable and Non-Renewable Fuses

Chicago New York

For Irrigation Service the Most Reliable Drive is

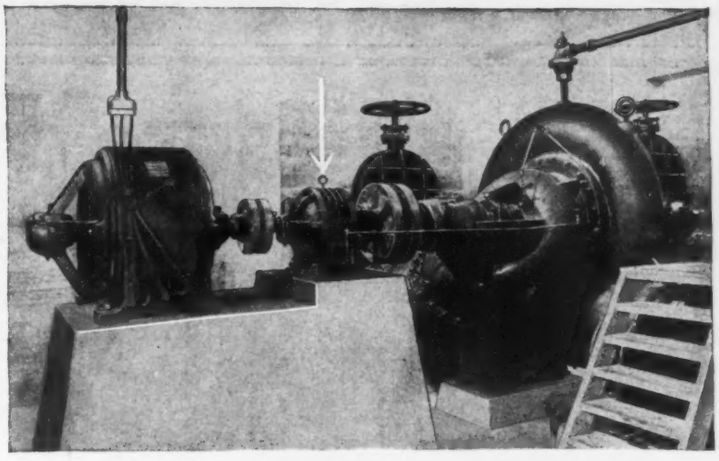
TURBO GEAR

FAST PATENTS

Centrifugal Pump Drive

Turbo Gear Steps Up or Steps Down Speed

The arrow shows the Turbo Gear



200-H.P. Turbo-Gear direct connected to motor driven 27,000 G.P.M. Centrifugal Pump. Speed Reduction 1800 to 328 R.P.M.

This photo shows one of four similar drives wherein the use of the

Turbo Gear Saved $2800.00 in First Cost

Turbo-Gears made possible the use of higher speed, more efficient, less expensive motors.

Turbo-Gears saved floor space—that's evident from the photo.

Turbo-Gears reduced maintenance charges to a minimum. If you want a reliable positive drive then you want a Turbo-Gear.

Write for Bulletin 100

The Poole Engineering & Machine Company

Manufacturers of Gears and Power Transmission Machinery Since 1843

Baltimore **Maryland, U. S. A.**

CHARLOTTE, N. C.....Realty Bldg.
CHICAGO.....Old Colony Bldg.
DALLAS.....1405 Southwestern Life Bldg.
DENVER.....First National Bank Bldg.
DETROIT.....423 Dime Bank Bldg.
EL PASO.....615 Mills Bldg.

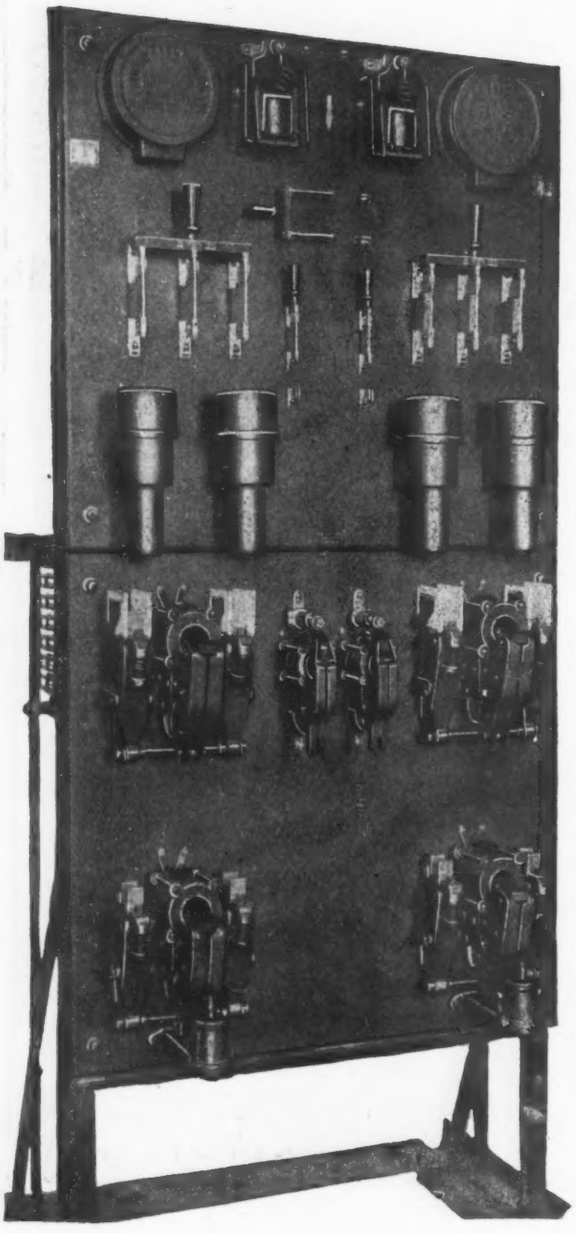
Canadian Representatives:
Engineering Company of Canada.....Montreal

MILWAUKEE.....Wells Bldg.
NEW YORK.....50 Church St.
PHILADELPHIA.....929 Chestnut St.
PITTSBURGH.....781 Union Arcade Bldg.
ST. LOUIS.....2211 Olive St.
SALT LAKE CITY.....218 Judge Bldg.
SAN FRANCISCO.....503 Mission St.
SEATTLE.....2012 L. C. Smith Bldg.
SYRACUSE, N. Y.....504 City Bank Bldg.

SUNDH'S SPECIAL PANELS

built to meet the requirements of a good specification

A Pressure Panel



with special provision for extra motor protection

This panel was installed in one of the small cities of the Middle West and was designed to automatically control two 20-hp., 3-phase, 60-cycle motors used to operate deep-well pumps which supply the local water requirements.

Specification for the panel is as follows: Marine finish slate panel at least 1¼ in. thick supported by angle iron frame and having mounted and wired thereon complete the following:

Two 20-hp. Automatic Starters for Slip Ring Type Motor; two 3-Pole Main Line Switches with Fuses; two pairs of Inverse Time Limit Hand-Reset Overload Relays; two Protective Relays so wired that motors cannot start up on Single Phase; two Gauge Type Pressure Regulators; one 2-Pole Double Throw Transfer Switch so wired that either starter may be operated by either Regulator; two Single Pole Double Throw Switches so wired that the pumps may be operated by hand or by the Pressure Regulators.

In addition to the above Equipment, a Single Pole Deep Well Tank Switch was furnished so wired that should there be insufficient water in the well the pump would be automatically cut out of operation.

Sundh Electric Co.

Ave. C & Parkhurst St., Newark, N. J.

New York Office: 51 E. 42nd St.

First National Bank, Pittsburgh, Pa.
H. J. Kaufman, Peoples Gas Bldg., Chicago, Ill.

Send Us Your Specifications

Circuit Breakers and Instruments for Small Switchboards

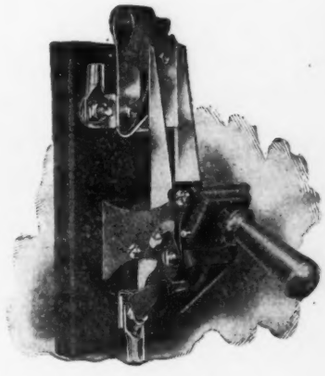
Manufacturers of "farm lighting plants" realize the necessity for employing accurate and dependable indicating and protective apparatus. The Roller-Smith Company offers for this application a line of instruments and circuit breakers which meet these specifications, but which are, nevertheless, reasonable in price.

This Industrial Type Circuit Breaker

is made in sizes from 3 to 100 amperes, inclusive, overload, underload, reverse current and combinations. The plain underload type which is most frequently used is truly

Non-Closable on Underload

It can be depended upon for prompt and positive disconnection of battery and generator when the underload condition exists.



"IMP" Ammeters and Voltmeters

are made in two sizes, 3 in. and 4 in. in diameter. Finish black, mechanism d'Arsonval type, scale divisions uniform, indications dead beat.

All ranges.

Send for Bulletins No. 71, No. 91, and No. 400.

Roller-Smith Company

233 Broadway, New York, N. Y.
Works, Bethlehem, Pa.

Monadnock Block Chicago — Williamson Bldg. Cleveland

METROPOLITAN-PROTECTIVE-DEVICES-
JUST ANOTHER WAY TO SPELL ECONOMY

Consider These Advantages

Tamperproof and Foolproof Features
Safeguarding of Revenue
Continuity of Service
Prevention of Unauthorized Interference
Safety to Life
Elimination of Fire Hazard
Uniformity of Service Equipment
Accessibility for Repairs and Tests
Economy of Installation Expenses
Prevention of Overfusing

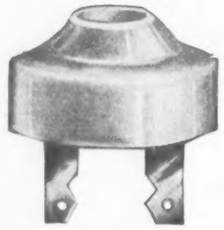
Now Try Them And Be Convinced

METROPOLITAN ENGINEERING COMPANY
1250 Atlantic Ave. Brooklyn, N.Y.
Canadian Representative: Metropolitan Engineering Co.—Ltd
90 Sherbourne Street Toronto, Canada

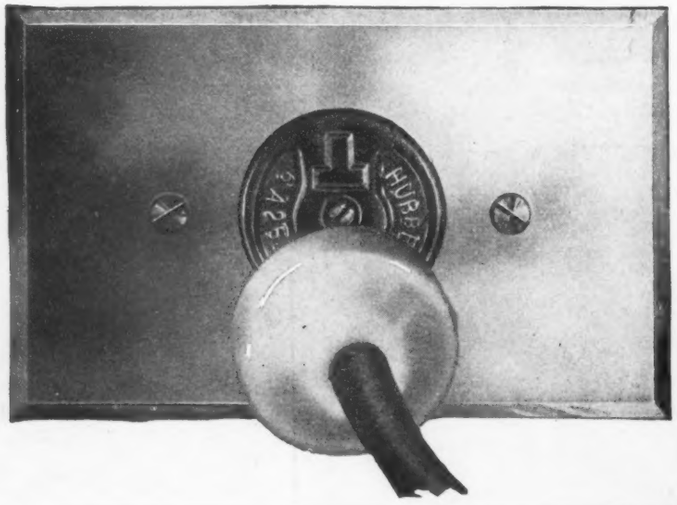
HUBBELL

STANDARD

PLUGS and RECEPTACLES



WHEN judging the jumping ability of our friend, Mr. Frog, it's well to remember the old adage about not placing too great a value on appearance. But speaking of appearance—you've noticed the superiority of **Hubbell Standard Plugs and Receptacles** in the mere matter of good looks. And when you come to consider their serviceability and safety—qualities of the most vital importance—the difference between them and other devices of this character is even more pronounced.



We Make Receptacles to Take Hubbell Standard Interchangeable Caps

HARVEY HUBBELL, Inc., Bridgeport, Conn.

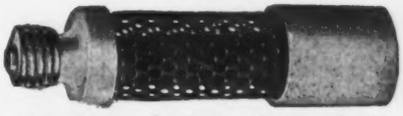
Ward Leonard

RESISTANCE UNITS

WITH VITREOUS ENAMEL INSULATION

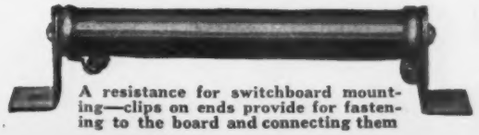
Using lamps as resistances is at best a crude, inexact and unreliable makeshift. A filament will burn out; a bulb may be broken; the resistance varies with the life of the lamps. It's one trouble after another.

Eliminate the uncertainties—replace lamps with WARD LEONARD Resistances especially designed for the purpose. The Edison plug end screws right into the lamp socket and provides a resistance constantly accurate. It never gives trouble because all WARD LEONARD Resistance Units are wound on a substantial porcelain tube—the terminal connections are made mechanically and electrically perfect—and the entire unit then hermetically sealed by the vitreous enamel insulation—free from any corroding or electrically-destructive influences. **Get posted** on our complete line.

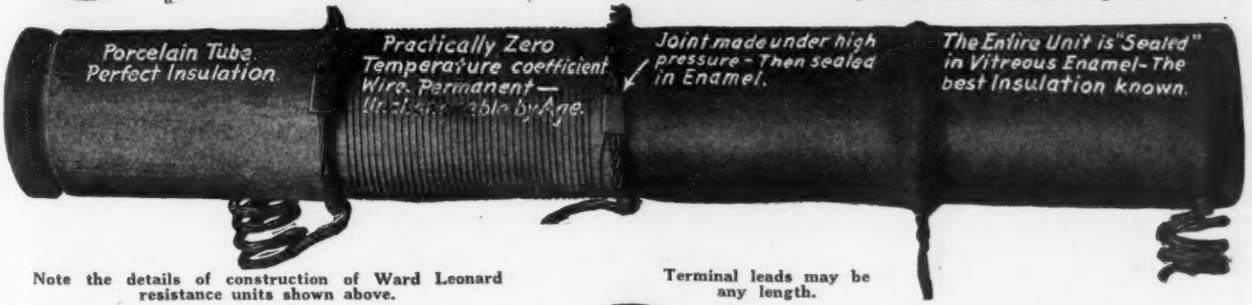


A resistance for interposing in the line. Edison screw plug on one end. Edison socket on the other.

A resistance for fuse block mounting—ferrule ends to slip into fuse clips



A resistance for switchboard mounting—clips on ends provide for fastening to the board and connecting them


Porcelain Tube. Perfect Insulation.
Practically Zero Temperature coefficient Wire. Permanent—
Joint made under high pressure - Then sealed in Enamel.
The Entire Unit is "Sealed" in Vitreous Enamel - The best Insulation known.

Note the details of construction of Ward Leonard resistance units shown above.

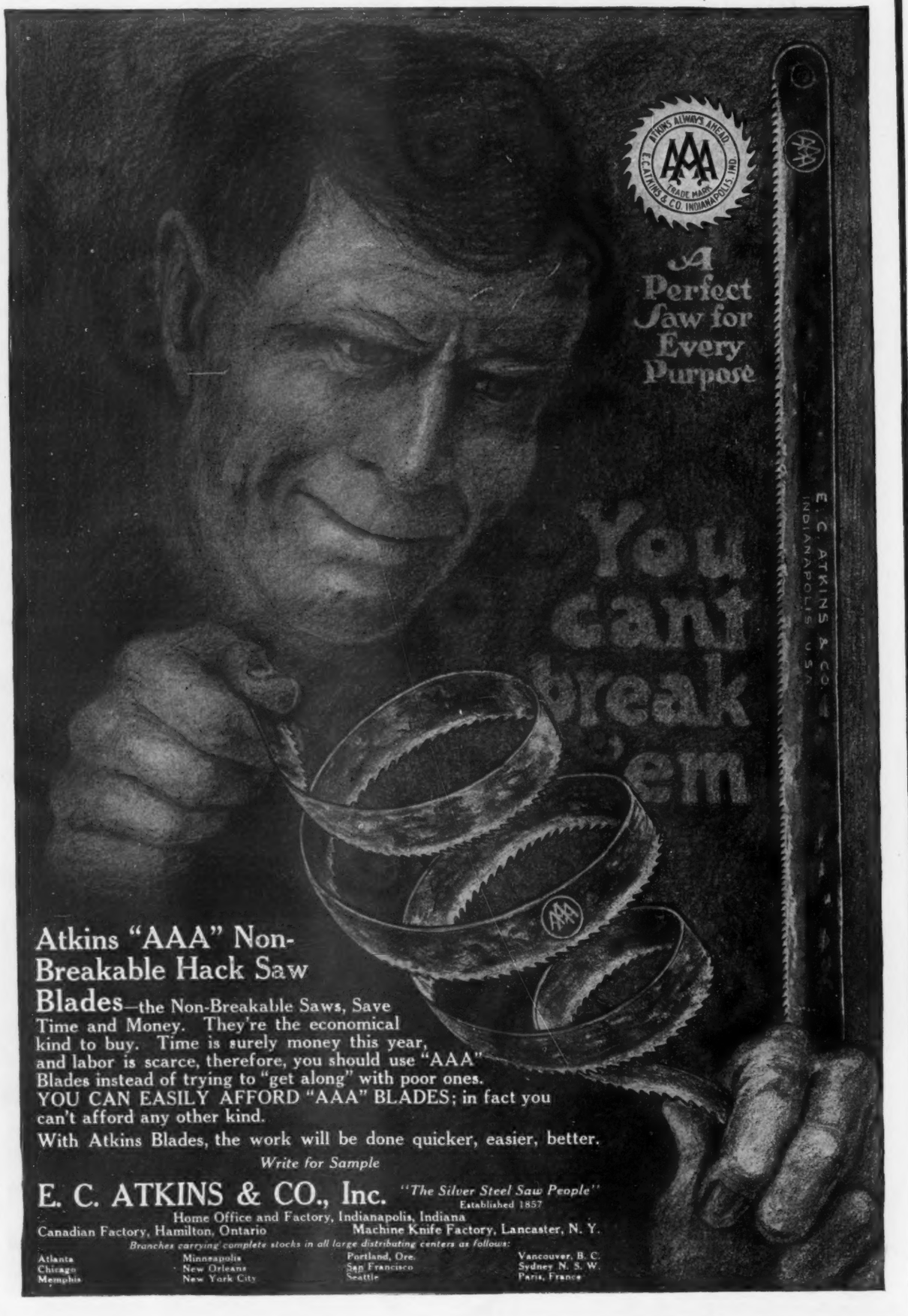
Terminal leads may be any length.

Ward Leonard Electric Company

Mount Vernon, New York

Westburg Engineering Co.—Chicago
Wm. M. Tompkins—Phila., Pa.
Morse Engineering Co.—St. Louis, Mo.
Electric Material Co.—San Francisco

Walter P. Ambose—Cleveland
Sperry & Bittner—Pittsburgh, Pa.
Electrical Specialties Co.—Detroit


ATKINS ALWAYS AHEAD
AAA
TRADE MARK
E.C. ATKINS & CO. INDIANAPOLIS, IND.
A Perfect Saw for Every Purpose
You can't break 'em
E. C. ATKINS & CO.
INDIANAPOLIS U.S.A.
AAA
Atkins "AAA" Non-Breakable Hack Saw Blades—the Non-Breakable Saws, Save Time and Money. They're the economical kind to buy. Time is surely money this year, and labor is scarce, therefore, you should use "AAA" Blades instead of trying to "get along" with poor ones.
YOU CAN EASILY AFFORD "AAA" BLADES; in fact you can't afford any other kind.
With Atkins Blades, the work will be done quicker, easier, better.
Write for Sample
E. C. ATKINS & CO., Inc. "The Silver Steel Saw People"
Established 1857
Home Office and Factory, Indianapolis, Indiana
Canadian Factory, Hamilton, Ontario
Machine Knife Factory, Lancaster, N. Y.
Branches carrying complete stocks in all large distributing centers as follows:
Atlanta
Chicago
Memphis
Minneapolis
New Orleans
New York City
Portland, Ore.
San Francisco
Seattle
Vancouver, B. C.
Sydney N. S. W.
Paris, France

Now is the time for Night-Light Saving

With the clock's hands set forward an hour, a million tons of coal have been saved since last April.

But now the days are getting shorter and the nights longer. So we turn our clocks back an hour to make them more nearly agree with sun-time. This is the time for night-light saving.

If every electric-lighted home used the MAZDA Lamp only, and if everybody adopted the rule never to leave a room without turning off the electric light, the saving in electricity would keep several large war industries supplied with coal or electric power as long as the war lasts.

We are making this timely appeal for economy and efficiency in the use of current for light to the American public through the pages of The Saturday Evening Post of November 2nd and the Ladies' Home Journal for November. It is one expression of our desire to aid to the utmost in the conservation program of the U. S. Fuel Administration.

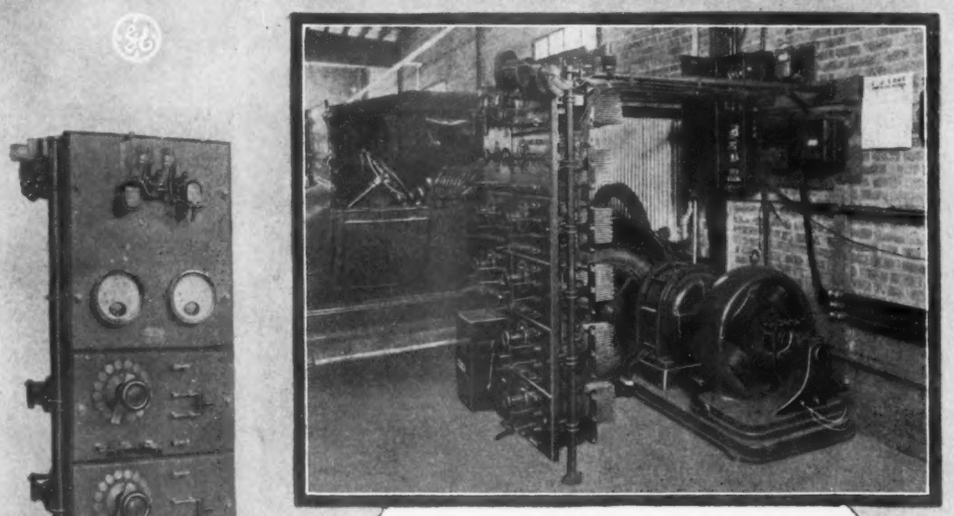
We have every confidence that the producers of electric current and the sellers of incandescent lamps will also give their whole hearted co-operation to Dr. Garfield in the spirit as well as in the letter of their pledge.

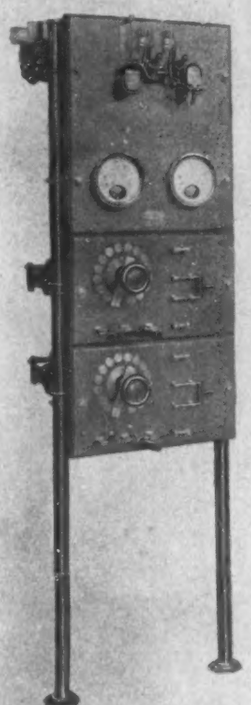
EDISON LAMP WORKS OF GENERAL ELECTRIC CO.

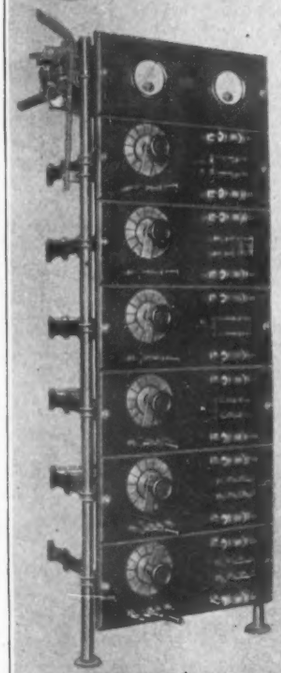
47D-21

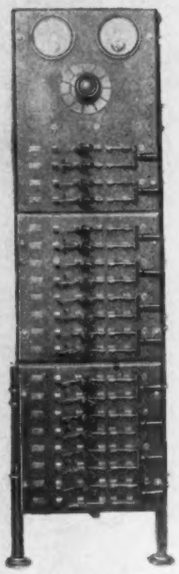
EDISON MAZDA

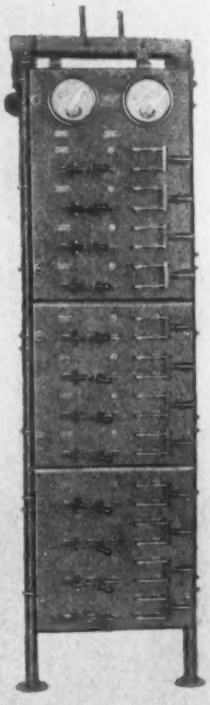
GENERAL ELECTRIC COMPANY











Electric Vehicle Battery Charging

It is possible to charge a vehicle battery through a bank of lamps—or a big resistance. But it is slow and inefficient.

The Public Garage must be ready to charge any type of car quickly and at a reasonable power cost.

The Private Garage in a manufacturing plant or department store has definite types of cars to charge and can secure equipment which will be simple and yet give maximum efficiency.

The General Electric Company has studied hundreds of such problems. A few of the charging boards recently furnished are illustrated on this page.

Complete equipments include charging panels, control and motor generator sets—are selected for the special requirements of the purchaser.

When you have a Garage Problem—ask the nearest G-E Office to put you in touch with our engineers.

7933

General Electric Company

General Office Schenectady, N.Y.

Where to get G-E Service

This page is prepared for the ready reference of the readers of the ELECTRICAL WORLD. To insure correspondence against avoidable delay, all communications should be addressed to the G-E sales office, G-E distributing jobber, or G-E foreign representative nearest the writer.

OFFICES AND DISTRIBUTORS IN THE UNITED STATES

LOCATION	G-E DISTRICT OR SALES OFFICE	G-E DISTRIBUTING JOBBER
Alabama, Birmingham	Brown-Marx Bldg.	Matthews Elec. Supply Co.
California, Los Angeles†	724 S. Spring. St.	Pacific States Electric Co.
California, Oakland		Pacific States Electric Co.
California, San Francisco†§	Rialto Building	Pacific States Electric Co.
Colorado, Denver†	First Nat'l Bank Bldg.	The Hendrie & Bolthoff Mfg. & Sup. Co.
Connecticut, Hartford	Hartford Nat'l Bank Bldg.	
Connecticut, New Haven	Second Nat'l Bank Bldg.	
Connecticut, Waterbury		New England Eng. Co.
District of Columbia, Washington	Comm'l. Nat'l Bank Bldg.	National Elec'l Supply Co.
Florida, Jacksonville	Heard Nat'l Bank Bldg.	Florida Elec. Supply Co.
Georgia, Atlanta†§	Third Nat'l Bank Bldg.	Carter Electric Company
Illinois, Chicago†§	Monadnock Building	Central Electric Company Commonwealth-Edison Co
Indiana, Fort Wayne	Ft. Wayne Elec. Works	
Indiana, Indianapolis	Traction Terminal Bldg.	Indianapolis Elec. Sup. Co.
Iowa, Des Moines	Hippee Building	Mid-West Electric Co.
Kentucky, Louisville	Starks Building	Belknap Hardware & Manufacturing Co. Inc.
Louisiana, New Orleans†	Maison-Blanche Bldg.	Woodward, Wight & Co. Ltd.
Maryland, Baltimore	Lexington St. Bldg.	Southern Electric Co.
Massachusetts, Boston†	84 State St.	Pettingell-Andrews Co.
Massachusetts, Springfield	Mass. Mutual Bldg.	
Michigan, Detroit	Dime Savings Bank Bldg.	Frank C. Teal Company
Minnesota, Duluth	Fidelity Building	Northwestern Electric Equipment Company
Minnesota, Minneapolis†	410 Third Ave., No.	Peerless Electrical Co.
Minnesota, St. Paul		Northwestern Elec. Equip. Co.
Missouri, Joplin†	Miners' Bank Bldg.	
Missouri, Kansas City†	Dwight Building	The B-R Electric Co.
Missouri, St. Louis†	Pierce Building	Wesco Supply Company
Montana, Butte†	Electric Building	
Nebraska, Omaha	Electric Building	Mid-West Electric Co.
New Jersey, Newark		Tri-City Electric Co. Inc.
New York, Albany		Havens Electric Co., Inc.
New York, Buffalo	10th Floor, Elec. Bldg.	Robertson-Cataract Elec. Co.
New York, Elmira	Hulett Building	
New York City§††	Equitable Bldg., 120 Broadway	E. B. Latham & Company Royal Eastern Elec'l Sup. Co. Sibley-Pitman Elec. Corp.
New York, Niagara Falls	Gluck Building	
New York, Rochester	Granite Building	Wheeler-Green Elec'l Sup. Co.
New York, Schenectady	G-E Works	
New York, Syracuse	Onondaga County Savings Bank Bldg.	Mohawk Elec'l Sup. Co.
North Carolina, Charlotte	Comm. Nat'l Bank Bldg.	
Ohio, Cincinnati†	Provident Bank Bldg.	The F. D. Lawrence Elec. Co.
Ohio, Cleveland	Illuminating Bldg.	Republic Electric Co.
Ohio, Columbus	The Hartman Bldg.	The Erner & Hopkins Co.
Ohio, Dayton	Schwind Building	The Wm. Hall Electric Co.
Ohio, Toledo	Spitzer Building	W. G. Nagel Electric Co.
Ohio, Youngstown	Stambaugh Bldg.	
Oklahoma, Oklahoma City*†‡	West Grande Ave.	
Oregon, Portland†	Elec. Building	Pacific States Electric Co.
Pennsylvania, Erie	Commerce Bldg.	
Penn. Philadelphia†§	Witherspoon Bldg.	Philadelphia Electric Company Supply Department
Pennsylvania, Pittsburgh†	Oliver Bldg.	Union Electric Company
Rhode Island, Providence	Turks Head Bldg.	
South Carolina, Columbia		Perry-Mann Elec. Co. Inc.
Tennessee, Chattanooga	James Bldg.	James Supply Company
Tennessee, Knoxville	Burwell Building	
Tennessee, Memphis	Randolph Building	Electric Supply Company
Tennessee, Nashville	Stahlman Building	
Texas, Dallas†	*Interurban Building	
Texas, El Paso†	*100 San Francisco St.	
Texas, Houston†	*Third & Wash. Sts.	
Utah, Salt Lake City†	Newhouse Building	Capital Electric Company
Virginia, Richmond	Va. Rwy. & Pr. Bldg.	
Washington, Seattle†	Colman Building	Pacific States Electric Co.
Washington, Spokane	Paulsen Building	Pacific States Electric Co.
West Virginia, Charleston	Charleston National Bank Building	
Wisconsin, Milwaukee	Public Service Bldg.	

*Southwest General Electric Company. †Warehouse. §Repair shop.

FOREIGN OFFICES AND REPRESENTATIVES

GENERAL FOREIGN SALES OFFICES—SCHENECTADY, N. Y.—120 BROADWAY, NEW YORK CITY—83 CANNON ST., LONDON, E.C., ENGLAND

LOCATION	G-E FOREIGN OFFICE OR COMPANY	G-E FOREIGN REPRESENTATIVE
Argentina, Buenos Aires	Cia General Electric Sudamericana, Inc.	
Australia, Sydney and Melbourne	Australian Gen. Elec. Co.	
Brazil, Rio de Janeiro	Companhia Gen. Electric do Brazil	
Central America, New York, U. S. A.		G. Amsinck & Company
Chile, Santiago, Iquique and Antofagasta		International Machinery Co.
China, Shanghai	American General Electric Edison Corp. of China	Andersen, Meyer & Co. Ltd.
Colombia, S.A., Barranquilla		Wesselhoeft & Wisner
Cuba, Havana		Zaldo & Martinez
Dutch E. Indies, Soerabaya, Java	Gen. Elec. Co. (of N. Y.)	
England, London	Gen. Elec. Co. (of N. Y.)	
India, Calcutta	Gen. Elec. Co. (of N. Y.)	
Japan, Tokio		Mitsui Bussan Kaisha, Ltd.
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Electrical World

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Daylight Saving Throughout the Year

WE NOTE with interest the efforts now being put forth in Congress to continue the daylight-saving program from the last Sunday in October *sine die*. During the summer months there unquestionably has been a certain amount of saving in the use of artificial light by the change of clock time. From now on the aggregate of this small gain will be decreased by the added use of artificial light during the morning hours. If according to program the various industries hold throughout the year to their old accustomed hours, the longer daylight saving is in force the larger will be the morning requirement for light. The result on the load curve of the central station should be rather beneficent. The evening peak, and especially the lap load, will be somewhat decreased, and additional load will be provided just prior to the beginning of the normal day load.

One may safely say that on the whole the daylight saving through the past summer can be regarded as a success, chiefly from advantages altogether collateral to the actual saving in light. Just how it will work out through the winter months remains to be seen. No country has yet tried it, although in an excess of economic fervor some of our British friends have suggested a two-hour difference of clock time instead of that now current. The detailed effect of so great an innovation can only be ascertained by experience, but this much is certain, that if it is thought wise to continue our present program through the winter the central-station industry can have no reasonable objection to make. It will gain a material amount of sales of energy and at a time when the use of such energy will have an effect upon the general load which may be regarded as altogether advantageous.

The enterprise upon which you have embarked is a hazardous and difficult one. This is not a war of words; this is not a scholastic struggle. It is a war of ideals, yet fought with all the devices of science and with the power of machinery.—President Wilson to the Students' Army Training Corps.

War's Influence Upon Radio Communication

IT IS a well-known maxim that war is an art which calls upon all the arts and sciences for its support. Per contra, war stimulates the development of various sciences and arts for its own benefit. Two very marked cases of this kind during the present war are the sciences and arts of aircraft and of radio-communication. It is probable that more progress has been made in these cases during four years of war than could have been expected in twenty ordinary years under peace conditions.

Experts tell us that we shall probably not be able to know much about the technical military history of this great world war until at least twenty years after it is over, while full details, if they are ever obtained for publication, cannot be expected for many years more. The books which have been written about the first Marne battle of 1914 show great divergences and lack of reliable information concerning some of the most prominent events. Yet this battle probably decided the fate of the civilized world. No books have yet appeared upon the almost equally important second Marne battle of 1918.

In a similar way, the actual developments in radio-communication during and due to the war are shrouded in military secrecy It will not be until after the close of the war that we shall have the results available in publications There is this difference, however, between the technical history of the war itself and the technical results produced by the war in engineering, that while the former may not be made generally known in this generation, the latter will speedily become distributed after the conclusion of peace—because the results attained will be fully as useful and necessary in peace as in war.

From a technical point of view, the most salient advance in radio-engineering made since the opening of the world war has been in the construction and use of vacuum tubes. These tubes have been so far improved and so much utilized for many purposes that vacuum-tube engineering seems to offer a promising new branch of electrical engineering, intimately associated with radio-engineering on one side and with electric power and wire communication on other sides. It is clear that the essential theory and the principal working applications of vacuum tubes will have to be learned by most electrical engineering students. The technical colleges and engineering laboratories of the world will have to teach these subjects in the future.

From an operating point of view, a striking feature of radio-engineering in the world at war with Germany is the great number of uses to which radio-communication is being applied. From the transmission of diplomatic notes across oceans to the regulation of troops and guns across short distances and small intervening obstacles, the electric waves are perpetually skimming over the surface of our globe. The number of radio stations is constantly increasing, and yet the power of selective and non-interfering communication is also keeping pace.

Notwithstanding the vast prospective increase in radio-communication all over the world, there is no im-

mediate prospect of a diminishing need for wire communication. No doubt the two systems of wire and wireless transmission will be more and more merged and consolidated, both in theory and practice, each being employed to supplement the other.

For the greatest causes the world has ever known the army you enter to-day is fighting and suffering and sacrificing.—Elihu Root to the Students' Army Training Corps.

Facts About Spot Welding

THE use of spot welding by electricity is rapidly increasing in a wide variety of applications, and the paper by Messrs. G. A. Hughes and R. H. Pool in our columns this week gives welcome data on some details of the process and on the energy required. There are many cases in which spot welding is greatly to be preferred to riveting. It is not by any means wholly a question of relative strength, but rather of strength plus convenience. There are many places in which it is very difficult to do a good job of riveting, or where a flush surface is desired and there is objection to countersinking the rivet head. Just there the spot-welding process often fits in admirably. In particular, thin material inconvenient to rivet can be worked with great facility and a comparatively small expenditure of energy. Heavy welding is merely a matter of power, but there seems to be no difficulty in working half-inch material with welders of very ordinary output. Thus the process is conveniently applicable not only to general sheet-metal working but to structural steel and to certain not inconsiderable features of shipbuilding.

The data secured by the authors were on stock of medium thickness, from $\frac{9}{32}$ in. (7 mm.) down to 18 gage, and the tests were made with a 30-kw. hand-operated machine, controlled by an auto-transformer in the primary of the welding transformer. In general, the spots were from $\frac{5}{16}$ in. to $\frac{7}{16}$ in. (8 mm. to 11 mm.) in diameter in the thicker materials. Roughly, the energy required was 20 kw. or 25 kw. and the time of a weld was from less than half a minute to a scant three-quarters of a minute on the heavier stock. On the thinner sheet stock the energy ran low, something less than 0.02 kw.-hr. per weld, and at a correspondingly increased speed. The power factor of the welder ranged in the various work somewhat on each side of 0.50. As to the strength of the spot welds, it proved to be highly satisfactory. On a series of welds of 14 gage sheet-steel single-lap joint the tensile strength of a pair of $\frac{5}{16}$-in. (8-mm.) spot welds proved to be fully up on the average to that of a pair of $\frac{1}{4}$-in. (6-mm.) rivets in drilled holes.

There seemed to be no room for doubt of regularly obtaining quite adequate strength in any case. As to the convenience of the process, it quite goes without saying that wherever a large amount of work has to be done under fairly uniform conditions the welding process can be made at least semi-automatic and a great saving of time and labor effected. The chief gain is the lessening of the amount of skilled labor required, which in these days is an item of the highest importance. The fact is that electric welding generally is just now coming into its own, and it will be found steadily replacing the old and reliable riveting in an increasing number of instances. Probably the two methods of uniting metals will continue to coexist, as each has a special field of applicability, but we feel very strongly that in fairly standardized work of almost any kind the automatic welding machine will find rapidly increasing use. The energy required is not costly, the process is quick, and the resulting joints are good. We are learning new labor-saving schemes at a magnificent rate under these war conditions, and as labor grows even scarcer one cannot afford to neglect any method that promises relief.

There can be no doubt of the issue. The spirit that is revealed and the manner in which America has responded to the call are indomitable.—President Wilson to the Students' Army Training Corps.

First-Class Wiring for War Plants

THE emergency character of building construction required in many war-industry plants leads one to ask whether temporary wiring may not suffice for such installations in place of the high standards normally enforced in shops and mills. A shortage in larger sizes of iron conduit has been and still is keenly felt. There are so many installations where conduit is vitally necessary, as in marine work, that it is natural to regard the war-industry plant of mushroom growth as a proper field for types of construction which ordinarily would be looked at askance by both the central-station man and the contractor.

No rigid rule can, of course, be laid down and followed regardless of conditions in such plants, and the first essential in every case is that such shops shall begin mass production with the irreducible minimum of delay. To get things moving, the engineer may have to concede, temporarily, now and then wiring arrangements not of the best. But only temporarily. The penalties of poor wiring are their own condemnation, and beyond this the ultimate cost of sub-normal standards in wiring, even of fair quality, may be extremely heavy. In the interests of the lowest possible fire risk, of the maximum degree of personal safety to operatives and other employees, and of continued reliable service, all temporarily below-par wiring should be revamped and put on the plane of first-class practice at the earliest feasible moment. In the barracks of the cantonment abuse of the wiring by inquisitive or careless recruits who hang their wet uniforms upon open runs or attempt experiments for off-duty entertainment is far from an imaginary affair. In the munitions shop the forcing of heavy tools and of raw material through processes at top speed in the interests of production first of all tends to lead to mechanical injuries to wiring unless it is of the best possible type. Hence the field for the use of either rigid or flexible metal conduit is very important, as is the "fool-proofing" of switches, fuse boxes and other necessary impedimenta of the electric art. Despite the scarcity of iron conduit and the difficulties in obtaining deliveries even of orders placed half a year ago, the general use of this material should be insisted upon in all cases where its application means the avoidance of real disaster. It is significant that the United Illuminating Company of Bridgeport, Conn., has this year brought out a set of wiring rules

which raise the standard of installations in this important munitions community even above the normal insurance test of excellence, and other central stations and contractors may well make every effort to secure permanent work of the best type regardless of the pressure often brought upon them to sanction for an indefinite period methods of construction which are, to say the least, inherently hazardous.

Good wishes will not buy ammunition, nor will hopes cause Germany to surrender—it takes cash. While there is time invest in Liberty bonds.

Burning Pulverized Coal

FROM time to time we have described various experiments with pulverized coal as a fuel for central stations. Most of these appear to have turned out favorably. But this week we add to the list of experiences that of the Milwaukee Electric Railway & Light Company, which seems to be exceptionally significant from the care with which the experiments were conducted and the exact comparative results obtained. In this case the test was made in practical competition with well-handled mechanical stokers, and there was due allowance for the necessary factors of difference. The fuel used has to be pulverized and dried before it can be properly fed by the air blast. A pulverizer with a capacity of 4 tons per hour was provided and an indirectly fired drier of 15 tons capacity per hour. The fuel was taken directly from one of the ordinary coal bunkers, conveyed mechanically to the drier and thence to the pulverizer supply bin. On its way to the pulverizer a magnetic separator removes any magnetic fragments, and, thus cleared for suitable pulverizing, the fuel is fed through the mill. Thence it is carried by a screw conveyor to the storage bin in the boiler room, whence it is fired by an air blast fed by screw conveyors. Agitator wheels mix it thoroughly with air and the blast carries it into the furnace. This furnace is of the Dutch-oven type with a very liberal combustion chamber, a provision altogether desirable for securing efficient burning of fuel.

After thorough experiments as to capacity with this apparatus, a careful efficiency test was made. The net result of this showed an evaporation of 9.47 lb. of water per pound of coal (9.47 kg. of water per kilogram of coal). Considering the fact that the analysis of the coal showed nearly 14 per cent of ash and 2 per cent sulphur with 12,000 B.t.u. (3024 calories) calorific drive, it is very clear that the evaporative efficiency was exceptionally high.

From a practical standpoint, the ease with which full rating and efficiency are kept up on the boilers, freedom from cleaning the fires, ease of handling heavy overloads and good banking conditions combined to cause a decided advantage for the pulverized-fuel method. The net efficiencies seem so close as to constitute no particular advantage one way or the other so far as this only is concerned. It seems quite probable, however, that a grade of fuel can be burned in the pulverized state which would be likely to show less satisfactory results if fired in the ordinary manner. It is perhaps in this particular that the pulverized-fuel gain can be made to pay the best returns. At all events the data obtained in this Milwaukee test are of a character to make the central-station manager keep an eye out for possible gains along this line. Much will necessarily depend on local conditions, and further experiments should be made, particularly with decidedly inferior grades of fuel, since in the future one will have to deal with these with increasing frequency.

A lasting and worthy peace may be secured only through victory. The only way for most of us to bring this about is to help the government by buying Liberty bonds.

Economical Load of Transformers

IN OPERATING an alternating-current network with high efficiency in view it is obvious that attention must be paid to keeping down the transformer losses and that if the plant be scientifically handled the transformers in service will be regulated in number to suit the conditions. A brief article in our columns sets out the principles which must be followed in adjusting the transformer capacity to the load. The vital point of the matter is that as the load increases on a single transformer a second transformer, if available, should be cut in if by so doing the total losses will be decreased, and so on. The losses being the sum of core and copper losses, the addition of a second identical transformer doubles the total core loss and must therefore reduce the combined copper loss of the pair by an equal amount, which is another way of saying that it pays to add the second unit when the copper loss of the first is double its core loss.

The exact point on the rating of the transformer that is implied by this ratio depends on the particular characteristics of design. Where transformers of different types are used together, the same principles hold, but their application depends on the particular losses involved. The same sort of convenient graphic investigation here shown is useful in arranging an operating schedule for a generating plant, since here again the point of most economical operation is determined by the relation between the constant losses and those dependent upon the load.

The Coming Issues

THE observations which Dr. Charles R. Mann has made in studying how educational methods meet emergency needs will be given in the next issue of the ELECTRICAL WORLD with an outline of a method by which education can be made more effective. Another coming article will describe some features of plant design and apparatus arrangement embodied in the new Hampden steam station of the Turners Falls Power & Electric Company. Numerous itemized costs of construction will be included. Still another article will call attention to the urgent need for power producers as well as power users to improve their power factor if adequate power and maximum use of equipment are to be had. This will be followed by articles discussing details connected with the actual task of improving power factor. War-time lighting economies that have been suggested by the war service committee of the Illuminating Engineering Society will also be the subject of a paper.

Arrangements to Avoid Operating Difficulties—I

Special Attention Has Been Given in the New Dayton Plant to Handling Coal Economically, Obtaining Clean Intake Water, Providing Flexible Piping Layout and Furnishing Adequate Boiler-Room Instruments

GROWTH in load and the increasing difficulty of getting coal and water to its two existing plants in large enough quantities made it necessary for the Dayton (Ohio) Power & Light Company to build a new plant. The two old stations, which were rated at 15,000 kw. and 4300 kw. respectively, are both in the business district of Dayton. The former, which was originally designed for only 4000 kw., has literally outgrown the site. The new station is situated at Miller's Ford, a site which has three advantages: It is below the junction of four streams, where at the period of minimum flow water enough is available for a 100,000-kw. plant; it is on the "Big Four" Railroad, over which coal supplies can be delivered, and it is only 2.5 miles (4 km.) from the load center of the city. The ultimate rating of the new plant is 100,000 kw., but the machines so far installed have a rating of only 25,000 kw. In general the plant design follows what is considered well-established modern practice, but close attention to engineering details in design and construction has produced a plant in which it is believed the ordinary operating difficulties will be reduced to a minimum. Simplicity, ease and convenience of control, as well as economy of first cost and operation, were given careful consideration in all selections of apparatus and layouts. The present building will accommodate about one-half of the ultimate rating of the station. Above it towers the self-supporting steel stack, which is 16 ft. (5 m.) in inside diameter and stands 300 ft. (91 m.) above the boiler-room floor. The superstructure consists mainly of I-beams fastened together with bolts and distance pieces to form girders which are filled with concrete. This class of construction was adopted to save steel. The condenser pit has been made watertight in order to guard against leakage during high-water periods.

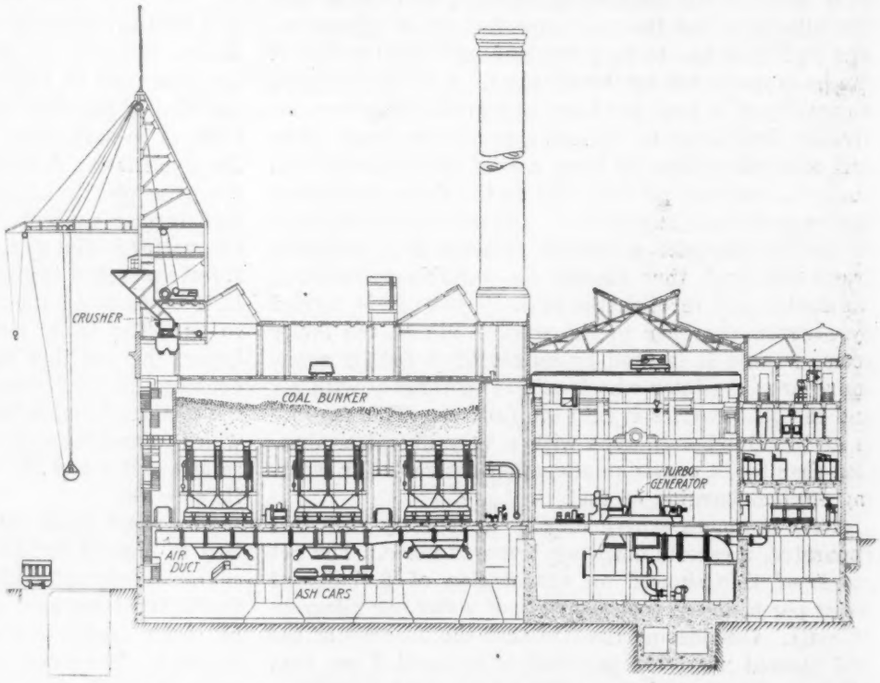


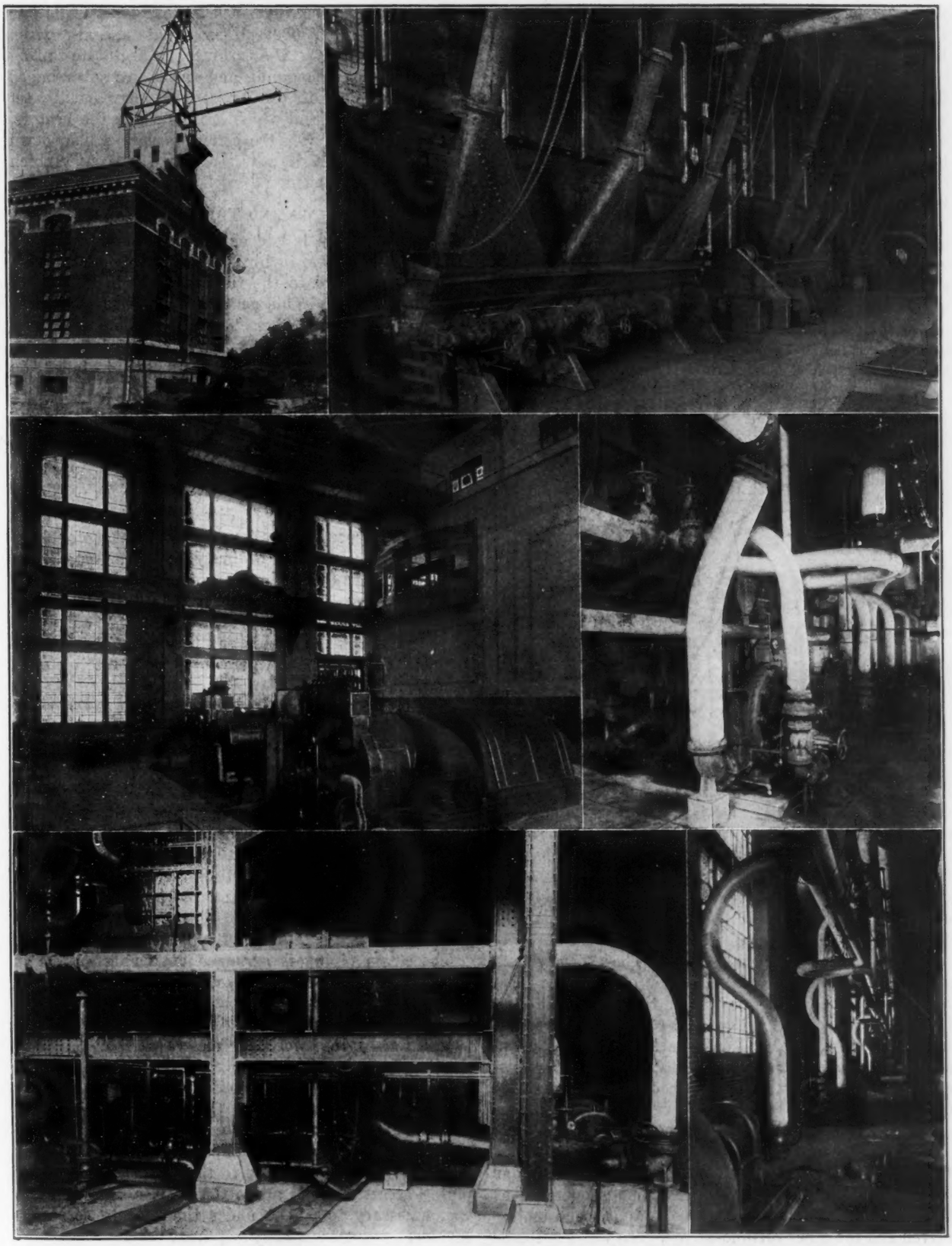
FIG. 1—CROSS-SECTION OF STATION, SHOWING COAL AND ASH HANDLING ARRANGEMENTS

For handling coal a steam hoist is used which operates a clamshell bucket discharging its contents into a hopper above the bunkers. From here the coal goes through a motor-driven crusher and is discharged into a cable car where it is weighed before it is distributed along the 975-ton bunkers over the boilers. The cable car is electrically operated and is controlled by a man who sits by the scale. When the coal is delivered it is dumped from the cars, if it is to be used immediately, into a concrete coal pocket which holds about six carloads. If it is to be carried in storage, it is unloaded by a locomotive crane and stored near the power house. The same crane can take coal from storage and dump it into the coal pocket. This general method of handling the coal was chosen because the equipment is economical to operate and maintain and because it was thought best adapted to get coal up to the station under high-water conditions. The system is rated at 90 tons per hour and is large enough to serve half of the ultimate plant.

Ashes go by gravity from the ash hoppers into side-dump cars which are hauled out onto the low ground around the station by a home-made gasoline-engine-driven tractor. For some time to come the company will use the ashes in filling up the 32 acres (13 hectares) of low land which it owns around the plant.

Instead of building the usual long intake extending upstream for circulating water, the Dayton company built an intake basin with the mouth pointing downstream so that the current of the river does not flow into it. By taking water out of the basin, trouble from gravel, driftwood and sewage getting into the circulating system is avoided, since it has an opportunity to settle to some extent. Besides, the intake tunnel is shorter.

The intake and discharge tunnels are side by side underneath the power house, being separated only by a 3-ft. (0.9-m.) wall of concrete. The difference in water temperature in the discharge and intake tunnels amounts to about 14 deg. Fahr. (—10 deg. C.). To take the water from the intake tunnel to the circulating pumps five



FIGS. 2 TO 7—VIEWS OF NEW DAYTON PLANT, SHOWING PORTIONS OF BOILER AND GENERATOR ROOMS, SOME AUXILIARIES AND CURVED PIPING USED TO ALLOW FOR EXPANSION AND CONTRACTION

large cast-iron intake tubes have been installed in the water-tight condenser pit. Those which are not already in use are covered with cast-iron covers which are bolted in place.

Owing to the fact that the water supply available is unfit for boiler use without treatment, a hot-process water softener is used to take care of the make-up, which was estimated to amount to 2 per cent of the total water evaporated. In order to keep down the size of water-softening equipment and at the same time take care of fluctuations in the demand for make-up and not operate the softener above rating, the following arrangement is used: A 10,000-gal. (38,000-l.) tank is installed on the roof and supplied with condensate from a concrete tank in the basement by means of two pumps operating at the rate of 100 gal. (380 l.) per minute, one motor-driven and one turbine-driven, their operation being controlled by a float valve in the roof tank. The water from the softener, which is heated to 200 deg.

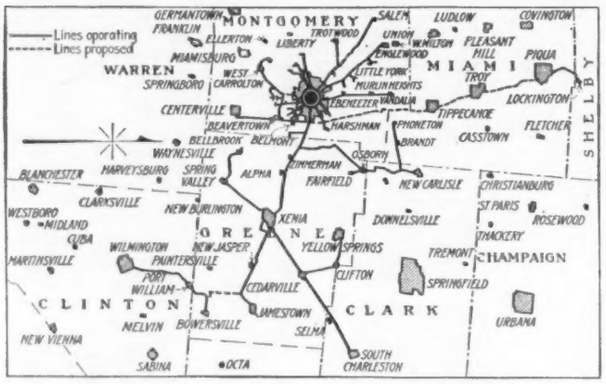


FIG. 8—TERRITORY SERVED BY DAYTON COMPANY

Fahr. (93 deg. C.) goes direct to the heater whenever the water level in the concrete overflow tank is lowered. This is accomplished by means of a Kitts water-supply regulator valve installed in the line from the softener to the heater and actuated by the level in the concrete tank. This valve will remain open until it has filled the roof tank and the concrete tank about one-half full by raising the level in the heater. It operates the float-controlled valve in the line from the condensate pumps to the heater, causing the condensate to overflow into the concrete tanks. The overflow tank also prevents the loss of hot water overflowing from the heater. The water supply from the roof tank to the heater is controlled by two float-controlled valves set at different levels. The condensate is used for gland sealing and wherever the well water would be troublesome. This well water contains about twenty-six grains of hardness originally, and when treated it contains about one grain of hardness.

The general water supply for the station is obtained from driven wells and is pumped to a roof tank similar to the one just mentioned by two pumps operated at the rate of 300 gal. (1140 l.) per minute, one motor-driven and the other turbine-driven. The water softener obtains its supply from this tank. In an emergency well water can be used directly for make-up. The fire pumps and general service pumps have two sources of supply—wells or river water from the discharge tunnel.

The boiler-feed pumps are directly connected to turbines. One pump is rated at 1000 gal. per minute and is driven by a 2400-r.p.m. E-5 type turbine, while two pumps are rated at 500 gal. per minute and are driven by a 2800-r.p.m. type D-5 turbine. To facilitate testing on water rates, the piping and valves are so arranged that the condensate can be sent to permanently set weighing tanks, from which it is taken to the heaters.

All blow-down from the boilers goes to a blow-down tank, from which it passes through a Lea V-notch weir for measurement.

THE BOILERS AND THEIR AUXILIARIES

The boiler room is laid out so that the three boilers which serve the two turbines are all in one aisle. This aisle runs parallel to the turbine room instead of at right angles to it. This general layout was selected to give a symmetrical design. The three boilers at present installed are rated at 1373 hp. and are of the cross-drum type. Vulcan soot blowers are installed on each boiler.

The furnaces are equipped with underfeed stokers having steam-operated dumps. The stokers may be driven either by an engine or an induction motor through a No. 6½ class E Reeves variable-speed transmisison. The introduction of this device was necessary since there is no source of direct current in the plant and variable speed with alternating-current motor drive was desirable. Under ordinary operating conditions the stokers are driven by the motor and the engine is held in reserve. The drive shaft is installed under the boiler-room floor in front of the stokers, where it is out of the way, but the engine and the motor are both on the boiler-room floor, where they will receive close attention.

The forced draft required by the stokers is supplied by three Sturtevant multivane blowers driven at 750 r.p.m. through gears with a ratio of 5.88 by a Sturtevant turbine. These fans will deliver 80,000 cu.ft. (2240 cu.m.) of air per minute against 7 in. of pressure (49 kg. per sq.cm.) at maximum rating. Control of the air delivered to the boilers is effected through sensitive air-pressure regulators.

In the uptake, gases go through a Murray cinder catcher between the boiler and the breeching. All of these passages are designed so that the velocities of gases will not be excessive at 300 per cent rating.

The steam piping is arranged on a ring system in which the largest size pipe used is 15 in. (38 cm.) outside diameter. Two steam outlets leave each boiler, a Bailey boiler meter being connected in each. While this practice of having two boiler meters per boiler may at first seem extravagant, it has already been proved in pratice that it is desirable to have such a check on the work the boilers are doing. On the ring header four motor-operated valves have been installed for sectionalizing. Each of these can be operated from the turbine room or from a point close to the valve. To make the piping accessible it is above the floor, except where it was necessary to run it under the floor to serve the turbine.

There is an auxiliary steam header in the boiler room and another in the basement of the turbine room for auxiliaries. All drips are taken to a common point, where the water is picked up by a Davidson horizontal automatic feed pump and delivered back to the boiler.

Insuring Against Disagreements Over Wiring

Bridgeport (Conn.) Utility Has Established Service Code Which Has Been Carefully Worked Out from an Engineering as Well as a Commercial Standpoint and Is Giving General Satisfaction

IN MANY central-station systems the regulations with regard to service wiring and transformer installations are loosely drawn and leave so much to implication that misunderstandings may arise between the customer and the company, with resulting friction and dissatisfaction. To insure first-class standard work with no opportunity for subsequent disagreements, the United Illuminating Company of Bridgeport, Conn., has recently established a service code which goes into particulars not provided in the National Electrical Code, supplementing the latter and not intentionally in conflict with it in any respect. Some of the points covered in these rules are given below. The code has been carefully worked out from the engineering as well as from the commercial standpoint.

Bridgeport, Conn.,
_____, 19__

To The United Illuminating Co.:

Kindly indicate point of service entrance and nature of current supply for _____ watts in lighting and _____ HP. in motors, in the premises at _____ St.
_____, Conn.

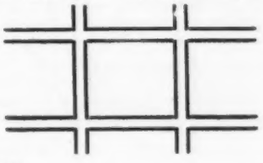
There will be _____ separate tenants.

Information requested by _____

Service will be:

Lighting { DC. { _____ Volts, _____ Wire,
AC. 60 Cy. { _____ " , _____ " , _____ Phase.

Power { DC. { _____ " , _____ " ,
AC. 60 Cy. { _____ " , _____ " , _____ Phase.



Remarks: _____

This information not valid after _____

THE UNITED ILLUMINATING CO.

By _____

Dated _____

FIG. 1—PLANK SERVICE CHARACTERISTICS FORM

Diagram map of service entrance location insures accuracy in planning of exact kind of service wanted and available. Issued in duplicate, one copy going to electrical wiring contractor and one to the United Illuminating Company's file.

In accordance with the general practice, the company provides at its own expense overhead low-tension service wires from existing overhead lines to the nearest outer wall of the customer's building, provided that the distance from the curb to the point of service connection does not exceed a stated amount—in this case 50 ft. (15 m.). Other less common provisos, however, are that no obstruction shall prevent the service wires from extending directly, in the clear, from pole to building, and also that no property not owned or controlled by the consumer is interposed between the pole and the point of service connection. When the distance exceeds 50 ft. the added expense due to the excess distance is charged to the consumer. The consumer or his representative is expected to apply for the location of the service attachment at the office of the company. In order that no question may arise concerning the location or nature of energy supply or needless expense be incurred, the location of the service attachment must be secured from the company on a blank provided for the purpose before appliances are purchased or the wiring installation begun.

The company requires that service pipes, which should be included in wiring contracts, of approved rigid iron conduit at least ¾ in. (19 mm.) inside diameter, be run outside of and securely fastened to the building walls, extending from the point of service attachment designated by the company to the point where it enters the basement, and continuously to the main service switch. If the main service switch, in order to avoid coal bins or toilets or to be placed in a public space, must be installed in the rear of the building, the service pipe may be run down outside the wall so as to enter the basement wall near the required location of the service switch. The service pipe must run to height sufficient for the company's service wires to clear the roadway not less than 18 ft. (5.5 m.). At the outer end the service pipe must terminate in an approved weather cap and at the inner end in an approved salable service box if the meters are remote from the entrance. If the meters are at the same location with the main service switch, the company has a standard protective box which is used. Effective and permanent grounding of the service pipe is insisted upon, and single-conductor, rubber-covered wire, approved by the company for the voltage supplied, and in no case less than No. 12 B. & S. gage, is specified to be used in the service pipes, extending at least 2 ft. (60 cm.) beyond the outer end of the pipe, with all wires plainly marked.

_____, Bridgeport, Conn., _____ 19__

To The United Illuminating Co.,

Gentlemen:—

You are hereby authorized to install in the premises No. _____ _____ St., _____ Conn., the following material:

_____

_____

_____

_____

_____

_____

_____

_____

For the above, bill me the sum of _____

Signed _____

Address _____

FIG. 2—INSTALLATION AUTHORIZATION CARD ORDER

On this consumer agrees to pay cost of all labor and material from curb to consumer's premises, including main service switch and fuses.

When the consumer requests or conditions require underground service from overhead mains, the customer is required to bear all expense for labor and material from the mains to his premises. Under no circumstances is any contractor allowed to attach wires to the company's overhead lines. Lead-sheathed cable is required for underground entrances, and the insulation requirements of the company are as follows:

INSULATION OF SERVICE CABLES

Volts Between Wires	Size of Wire	Insulation Thickness in 1-64 In.	Lead Sheath Thickness in 1-64 In.	
			1 Wire	2 or 3 Wire
Below 600	No. 8—No. 2 B.&S.	4	6	6
Below 600	No. 1—No. 0000	6	6	6
Below 600	225,000 circ. mil. to 2,000,000 circ. mil.	8	6	7
Below 2500	All sizes	12 (30% Para)	..	7
2500 to 6800	All sizes	16 (30% Para)	..	7
Below 2500	All sizes	12 (var. cambric)	..	7
2500 to 6800	All sizes	16 (var. cambric)	..	7

The United company specifies further that with underground service entrances the cables must be placed in galvanized-iron conduit not less than 1½ in. (38 mm.) in inside diameter; all 90-deg. bends are to be not less than 18-in. (45.7-cm.) radius, and the conduit is run at least 3 ft. (91.4 cm.) below the ground surface. From a point 8 ft. (2.4 m.) above the sidewalk the company requires that the pipe be inclosed in fiber conduit extending to the chafe bushing or pothead on top of the pipe. The sections of fiber conduit are required to be connected together with standard screw couplings and clamped to the pole at least every 5 ft. (1.5 m.), and with screws not smaller than 2 in. (5 cm.). One clamp is fastened to the pole directly under the lower end of the fiber conduit to prevent its slipping down on the pipe.

For low-tension service wires the pipe top is protected by a terminal box furnished by the company and charged to the consumer. For 600 volts and higher service the pipe ends at the pole and building are threaded, and the cable is protected by a suitable pothead approved and installed by the company at the expense of the consumer. No wire less than No. 8 B. & S. gage is permitted in such service pipes, and the maximum drop allowed between the overhead street mains and the main service switch in the basement is 1 per cent. Where a new service tap is required from underground street mains of the company, the company installs the tap after receiving a written order from the consumer that the latter will pay the cost of all labor and material from the curb to his premises, including main service switch and fuses. In case the service to be connected is less than 1 kw. the customer is now required to pay the entire cost of the service extension.

When several stores or apartments are grouped in one block, the load may be too great to permit the transformers to be placed on poles, as may factory loads also. In such cases, at the discretion of the proper company official, the consumer is required to furnish the platform or vault at his own expense. In general, the limit in size for transformers to be placed on a pole is two 10-kva. units or their equivalent. The wiring of transformer vaults is installed only by the company and at the consumer's expense. When transformers are installed in an interior vault, this must be placed against the street wall, and besides being in accordance with the National Electrical Code, the following points are insisted upon by the company:

Floor dimensions and head room depend upon the size of the load and are specified by an official of the company upon request. A suitable, approved padlocked fire door is required to be not less than 48 in. (124.4 cm.) in width of clear opening and of a height depending on the size of the transformer. Wider door openings are of course required in large factory vaults. The central-station representative determines the location of the door, and a sill 4 in. (10.16 cm.) high is required at the doorway of the vault as a protection against oil and water. Another requirement is a passageway allowing transformers to be installed without cutting away building walls. When possible, an outside entrance through the sidewalk is provided. In these vaults the company permits no combustible material, water, gas, sewer or other pipes. Ventilation is enforced by means of an air inlet placed not more than 1 ft. (30.4 cm.) above the floor line and an outlet at the ceiling line. In case of vaults inside buildings both inlet and outlet are piped to the outer air. The required area of ventilating ducts is not less than 36 sq.in. (232 sq.cm.) per 100 kva. of transformer capacity or fraction thereof. Protection of the openings from rain or snow and foreign materials is another stipulation, and the lower edge of the ventilating inlet is set at least 4 in. (10.16 cm.) above the floor line. All such vaults are provided with drainage connections, and the wiring, which is installed

Bridgeport, Conn., ... 191.....

TO THE UNITED ILLUMINATING COMPANY:

You will please install in the premises ..... Floor, No. ..... Street, ... Connecticut, the following: .....

.....

for which ..... agree to pay you on completion of the work, $ ....., you to furnish the meter and setting for operating the same, which are to remain your property.

In consideration of your supplying electric current to the above equipment, ... agree to use, subject to the terms and conditions printed on the back hereof, which are made a part of this contract, electric current through said meter for the term of one year from the date hereof, and thereafter until terminated by thirty days' notice in writing from either party, or as provided in condition No. 2 above referred to, and further agree to pay for said electric current as measured by the meter provided by the Company, at the rate of 7½c. per kilowatt hour, payable as provided by the terms printed on the back hereof; and I further agree to use electric current to the amount of $12.00 per year at the above rate during this contract, or failing to use the same, agree to pay the Company $12.00 per year until this contract is terminated; and I also agree to pay for any and all labor, materials and supplies furnished me in connection with the use of said electric current upon receipt of a bill therefor, and also agree that all appliances hereafter installed shall be usable on your alternating current service.

(Signed) .....

For and in consideration of the furnishing of the meter and of the electric current above described, and labor, materials and supplies referred to in the above agreement, and for value received, I guarantee the performance of all the agreements in the above contract mentioned to be performed by the signer thereof, during the continuance of the contract, without requiring any notice of non-payment, or non-performance, or proof of notice or demand being made, whereby to charge me therefor.

Dated at Bridgeport, Connecticut, this ..... day of ..... 191.....

Witness:— Name .....

..... Address .....

FIG. 3—LIGHTING CONTRACT CARD FORM WITH PAYMENT GUARANTEE (GENERAL TERMS AND CONDITIONS ON REVERSE SIDE)

only by the company and at the consumer's expense, includes underground cable and all transformer wiring. The consumer arranges to have his wiring contractor bring the mains to the vault, with ground connections when necessary, the mains being long enough to connect to the secondary bus. Meters and secondary overload protective devices are not permitted in the vault, but are preferably placed just outside the vault walls and in an accessible public space.

All lighting installations of more than 660 watts are wired for three-wire connections, and the company requires that an installation containing fewer than twenty sockets must be balanced within one socket; between twenty and fifty sockets the balancing must be within 10 per cent, and with more than fifty sockets balancing

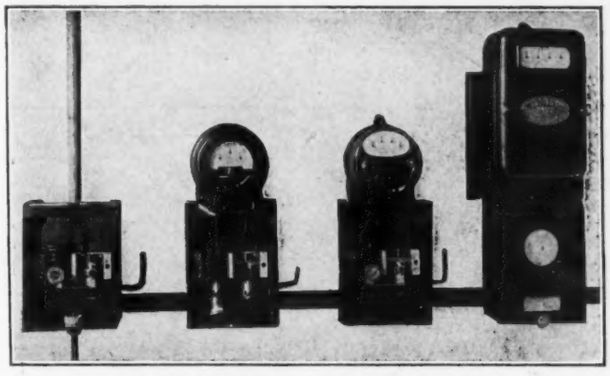


FIG. 4—PROTECTED SERVICE AND METER BOXES USED BY BRIDGEPORT COMPANY

Boxes manufactured by Metropolitan Engineering Company, Brooklyn, N. Y. By running a solid neutral, the same box adapted can be used for both two-wire and three-wire meter service. By cutting away top of box, as suggested by United Illuminating Company, and as shown above, meter does not have to be made an integral part of box structure, saving metal and increasing compactness of layout. Meter is recessed into space in upper part of box as shown, and is rendered tamperproof by close-fitting box cover.

is required within 5 per cent. Show windows are balanced against one another unless a single show window contains more than three sockets, in which case it is balanced within itself. Chandeliers containing more than twelve sockets are required to be balanced within themselves. In combined single-phase installations of light and power, all power of ¼ hp. (186.5 watts) or more is specified to be 220 volts, and balancing is required as outlined above under sockets. Each floor is required to be balanced within itself, and where there are two or more suites of rooms on one floor each suite is required to be balanced within itself. In every case of addition to an old installation the company requires the same attention to balancing as on a new job.

My advice to the young man taking the electrical or mechanical course would be to supplement his regular work with as much hydraulic engineering work as possible, for the indications are that when the industries of the world are once more operating on a peace basis unusual activity will be concentrated in water-power developments all over the country.—*S. A. Redding, General Superintendent Clerical Department, Georgia Railway & Power Company.*

THE ECONOMICAL LOADING OF TRANSFORMER BANKS

Curves Which Make It Possible to Keep the Most Economical Number of Transformers in Service—Units of Uniform Size

WHERE several transformer banks of similar characteristics are available to carry a variable load it is of interest to determine the economical point for switching an additional unit into service. Ordinarily this is done when the load has reached the capacity of the working units, but this may not always be the most economical practice. Obviously, switching in an idle unit will increase the total core losses which are constant for each unit, but the corresponding decrease in the variable or copper losses

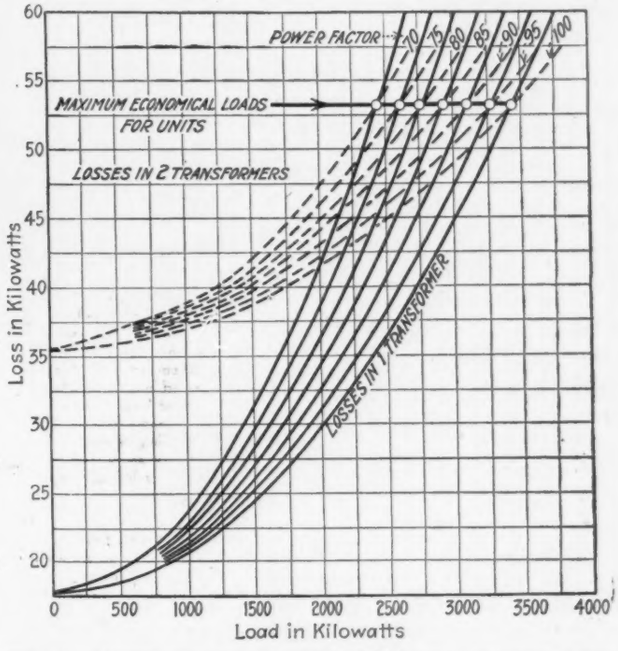


FIG. 1—LOSSES IN THREE-PHASE, 3000-KVA. TRANSFORMERS UNDER VARIABLE LOADS

Gives comparison between losses in one unit carrying total load and two units each carrying one-half of total.

may more than counterbalance this increase. As the ratio between these losses differs widely in different classes of transformers, it is necessary to investigate each case individually.

Fig. 1 is a sample set of curves indicating the losses in a 3000-kva. three-phase transformer for varying loads and power factors. From this the loss in kilowatts may be read directly for any load at any power factor. The curves are plotted in kilowatt load rather than kilovolt-amperes, as the load may be read directly in kilowatts on the station meters and will thus permit the operator to pick the economical switching point more readily than if expressed in kilovolt-amperes. The curves are based on test results or data furnished by the transformer manufacturer. On the same sheet is plotted a second set of curves showing the total losses in two transformers, each carrying half the load. These curves may be readily calculated from the first set.

For instance, at unity power factor and 1500-kw. load, the loss in one transformer is seen to be 24.5 kw.

Therefore, for a total load of 3000 kw., if two transformers are used the total loss will be 49 kw., which gives one point on the unity power-factor curve of the second set. Each loss curve for two units intersects the corresponding loss curve of one unit, beyond which point of intersection it will be more economical to operate two units than one. It will be noted that in the particular example given the economical point on the unity power-factor curve is at 3430 kw. (or kva.), or slightly more than full load. On the 70 per cent curve the intersection is at 2440 kw., or 3486 kva. Thus it will be seen that the economical point of change is at a practically constant kva. load regardless of power factor. It will also be noted that the economical switching point is at a constant value of loss regardless of power factor, and that this point is that at which the total loss in one transformer is three times

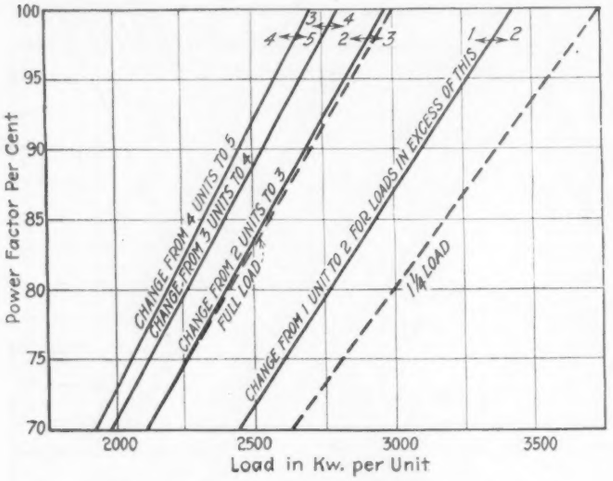


FIG. 2—ECONOMICAL SWITCHING LOADS
Thus if the load reaches 3000 kw. at 87 per cent power factor, it becomes economical to switch in a second transformer.

the core loss in one transformer. This may be readily proved for identical transformers as follows:

Let W = total transformer loss,
W_c = core loss of one transformer,
W_{c_1} = copper loss of the single transformer,
W_{c_2} = copper loss of one transformer of the bank of two,
I = equivalent load current,
R = equivalent transformer resistance.

Then for one transformer:

$$W = W_c + W_{c_1} = W_c + I^2R,$$

and for two transformers:

$$W = 2W_c + 2W_{c_2} = 2W_c + 2(I/2)^2R.$$

Equating for condition of economical switching point,

$$2W_c + 2(I/2)^2R = W_c + I^2R,$$
$$W_c = I^2R/2 = W_{c_1}/2;$$

or, the economical point is that at which the core loss in the single transformer equals one-half the copper loss in that transformer, or one-third the total loss.

Similarly, with the two units in service it will be most economical to switch in a third when the core loss per transformer equals one-sixth the total copper losses or when the core loss in one of the pair equals two-thirds the copper loss in one of the pair. For $W = 2W_c + 2W_{c_2} = 2W_c + 2(I/2)^2R = 2W_c + I^2R/2)$ and

$$W = 3W_c + 3W_{c_2} = 3W_c + 3(I/3)^2R = 3W_c + (I^2R/3).$$

Equating,

$$2W_c(I^2R/2) = 3W_c + (I^2R/3),$$
$$W_c = I^2R/6 = 2W_{c_2}/3;$$

or, in a general way, when n units are running switch to $n + 1$ units, when the losses per transformer are $W_c = nW_{cn}/(n + 1)$.

These results are plotted in Fig. 2 for a number of combinations. Knowing the load per unit, the operator can tell at once when it will be economical to switch a unit on or off. If the load is known in kva., the division points on the unity power-factor line should be used.

While the above equation holds true only for groups of identical transformers or other apparatus having losses partly constant and partly varying with the square of the load, the graphical investigation may be suitably modified to apply to generators, dissimilar transformers or other apparatus.

Belgium Shall Be Free—Buy Bonds

CONSIDERATIONS NECESSARY IN CHOOSING CONDENSERS

With High Efficiency a National Necessity, It Is Important to Choose Condensers of Correct Type and Design for Each Plant

IN THESE days when fuel is scarce and high in price too much stress cannot be laid upon the best possible economy in power-plant operation. Careful operation will be of no avail, however, if the condensing equipment is not chosen to the best advantage. This subject was discussed at the recent annual convention of the Association of Iron and Steel Electrical Engineers by D. D. Pendleton of the Wheeler Condenser Company, in a paper entitled "Condensers and Condenser Engineering Practice."

The paper by Mr. Pendleton included a comprehensive discussion of the three principal types of condensers, namely, surface condensers, low-level jet and barometric condensers. Vital points in the selection and operation of these condensers were brought out. The author warned against the practice of making condenser requirements so high that the cost is not justified by the increased economy effected. This places a hardship upon the purchaser.

While the efficiency of a condenser may be expressed in one figure, namely, the terminal difference between the temperature of the steam or vacuum and the temperature of the water leaving the condenser, account must also be taken of the vacuum maintained and the power required by auxiliaries for any condenser system. The vacuum practical to maintain also depends upon the type of prime mover. A reciprocating condensing steam engine is seldom proportioned for more than 26 in. to 27 in. (660 mm. to 690 mm.), whereas a properly designed steam turbine should be so designed as to utilize properly the highest theoretical vacuum obtainable.

TYPES OF CONDENSERS

The barometric condenser lends itself most admirably to the use of very bad, dirty or acid water. Care must be taken, however, to see that the tail pipe of the con-

denser is positively large enough to carry off all water and débris by gravity without clogging. In the opinion of the author, this type is the most "foolproof" of all condensers. Where the exhaust piping is under, say, 4 ft. to 5 ft. (1.2 m. to 1.5 m.) in diameter an installation can be made well within practical possibilities for high duty up to slightly more than 28.5 in. (720 mm.) vacuum. Air leaks and other difficulties occur with exhaust piping that measures above 5 ft. (1.5 m.) in diameter.

Considering the low-type jet condenser, it has the same advantages and disadvantages as the barometric, but care should be given to the design of the discharge or tail pump, so that it will at all times keep the outgoing water ahead of the incoming water. Single jet condensers of 10,000 kw., or approximately 140,000 lb. (63,000 kg.), of steam per hour seem to be the practical limit in size.

Dirty or acid water becomes a very serious matter in the case of the surface condenser. There is no limit to the size of these condensers. They are now made in sizes from 50 sq.ft. (5 sq.m.) of surface up to 75,000 sq.ft. (7000 sq.m.) commercially, the latter size being capable under proper rating and design of condensing 600,000 lb. (270,000 kg.) of steam per hour. Another advantage of the surface condenser lies in the fact that it is generally considered to entrain only one-half as much air as either the barometric or jet condenser types. Regarding the water velocities of surface condensers, 15 ft. (1.5 m.) per second seems to be the average. All talk of 8 ft. to 10 ft. (2.4 m. to 3 m.) per second seems to be absurd in view of the fact that excessive power is required for such velocities. The greatest care should be exercised in keeping the tubes of surface condensers clean. A number of very ingenious methods have been devised for doing this cleaning. High velocities help, but the excess power required materially overbalances the cost incurred with mechanical cleaning.

Although the condenser surface required for any generating unit cannot be properly expressed in terms of square feet per kilowatt, still the author pointed out that in a number of typical cases this value ranges from 1.14 sq.ft. to 1.66 sq.ft. per kilowatt. Data taken from a number of recent installations show the steam condensation per square foot per hour to be 5.4 lb. to 8.5 lb. (2.4 kg. to 3.7 kg.) where the vacuum is about 28 in. (710 mm.) and the temperature of the incoming circulating water about 75 deg. Fahr. (24 deg. C.)

Auxiliary Pumps

Roughly, 90 per cent of the steam heat delivered to auxiliaries will be returned as heat to the feed water, provided that there is enough water at a suitable temperature to absorb this heat. At light load there is considerable danger of showing an excess of exhaust steam, which has led to the development of combined auxiliary drive, using turbines and motors. The use of economizers in connection with boilers emphasizes the desirability of avoiding an excessive amount of exhaust steam from auxiliaries. In some cases an excess amount of exhaust steam may be reclaimed by delivering it to an intermediate stage of the turbine; in fact, this has sometimes been proved very feasible and practicable as well as economical.

The writer suggests that the reciprocating rotative crank-end flywheel dry-vacuum pump, when used in connection with a proper condensate pump, is really the most efficient in point of power consumption, where space is available. It is practicable, say, up to 250,000 lb. (113,000 kg.) of steam per hour at a 28-in. (710-mm.) vacuum, but for jet or barometric work at the same vacuum about one-half that amount of steam can be handled. The hydraulic or turbo-air pumps are very generally used, and, although large consumers of power, they are very well adapted to all types of work where economy of space, convenience of arrangement, layout, etc., make them more practicable than other types. The steam jet is rapidly coming to the front and in some ways is proving more desirable than any other type. In specifying an air pump careful consideration should be given to the requirements under winter conditions with cold water. Regarding circulating-water pumps for condensing purposes, there is little call for any type except the centrifugal pump.

Auxiliary Power Required

A comparison of different types of condensers with regard to the amount of auxiliary power required is given in the following table:

	Surface, Kw.	Jet, Kw.	Barometric, Kw.
Water supply and tail pump	152	467	352
Condensate pump	34	...	...
Rotative dry-vacuum pump	86	114	114
Turbo-air pump	197	256	256
Steam-jet	215	250	250

From this table it may be seen that the total power required to drive auxiliaries for the three types of machines for a 10,000-kw. turbine varies from 2.7 per cent to 4 per cent with the surface, 5.8 per cent to 7.2 per cent with the jet, and 4.7 per cent to 6 per cent with the barometric.

We Want No Bernstorffs—Buy Bonds

Books Received

WIRELESS TELEGRAPHY AND TELEPHONY. By W. H. Eccles. London: Benn Brothers, Ltd. 514 pages, 434 illustrations.

AIRPLANE CHARACTERISTICS. By Frederick Bedell. Ithaca, N. Y.: Taylor and Company. 123 pages, illustrated. Price, $1.60 net.

ENGINEERING OF POWER PLANTS. By Robert H. Fernald and George A. Orrok. New York: Mc-Graw-Hill Book Company, Inc. 586 pages, 300 illustrations.

HANDBOOK OF MECHANICAL AND ELECTRICAL COST DATA. By H. P. Gillette and R. T. Dana. New York: McGraw-Hill Book Company, Inc. 1740 pages, illustrated. Price, $6.

A CALENDAR OF LEADING EXPERIMENTS. By William Franklin and Barry MacNutt. South Bethlehem, Pa.: Franklin, MacNutt & Charles. 205 pages, 107 illustrations. Price, $2.50.

COURS DE PHYSIQUE GENERALE. By H. Ollivier. Vol. III. Mouvements Vibratoires; Acoustique; Optique Physique; Ondes Electromagnétiques; Electro-optique; Effets Optiques du Mouvement. 632 pages, 378 illustrations. Paris: Librairie Scientifique A. Hermann et Fils. Price, 30 francs.

Checking Stored-Coal Temperatures Electrically

Effective Method of Detecting Incipient Fires in Piles of Stored Coal by Means of Electrical Thermometer—Coal Must Be Stored and Conserved from Unnecessary Waste

BY THOMAS W. POPPE

IT IS absolutely necessary at this time for the central stations to store coal. In the first place, the economical operation of the railroads requires it, and, again, such procedure is necessary in anticipation of serious delays in coal delivery during the winter period. The experience of the writer, who was charged with the responsibility of storing 10,000 tons of bituminous coal and protecting this coal against fire, may be of value to other central-station engineers.

The greatest danger connected with storing coal is in the slow combustion which takes place and is not detected until the odor of sulphuric fumes becomes noticeable. When this action commences the coal should be redistributed so that the pressure existing on the heating layer is removed. In some cases the entire coal pile would have to be turned over, since the greatest pressure is on the bottom, thus requiring quick action and the expenditure of a large sum of money. Any scheme whereby an increase of temperature in the coal pile can be detected or by which it can be retarded or prevented will therefore be a saving. To accomplish the first objective where the writer is engaged an electrical thermometer system was installed with the temperature-indicating instrument or pyrometer in the engineer's office. Switches were so arranged that the temperature of predetermined locations in the coal pile could be obtained almost instantly. The second objective was obtained by reducing the pressure on the heated layer, removing all the coal at that particular point if necessary. A temperature of 250 deg. Fahr. (120 deg. C.) was assumed to be the safe internal temperature; if the pyrometer showed a close approach to this figure, the coal at this point was immediately removed to the point nearest the place of consumption. This involved little additional expense in operating costs, as the coal would eventually find its way there anyway. This is not true of the "turn-the-coal-over" method, especially if the storage place is limited.

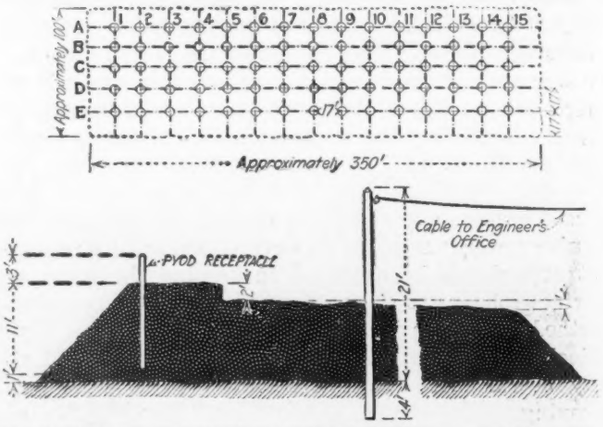
To keep within the safe temperature limits, the coal, as consumed, was removed from the top in 2-ft. (60-cm.) layers with a gradual slope toward the point of consumption. The removal of the two feet of coal reduced the lowest layer from the pressure of the removed weight, and the gradual slope made the work of the men with loaded wheelbarrows less than if a perfect level was retained. One advantage of the removal of the top layer was that additional shipments received could be methodically added and the good and poor qualities automatically mixed, maintaining a fair average.

Ten thousand tons of coal piled 12 ft. (3.5 m.) high meant that a ground area of 33,350 sq.ft. (31,000 sq.m.) would be required, assuming a value of 50 lb. per cubic foot (800 kg. per cu.m.). A trackage of 400 ft. (120 m.) permitted the unloading of coal on a plot 350 ft. by 100 ft. (100 m. by 30 m.).

For satisfactory detection of heat changes in the coal to be stored on this plot it was decided to place pyod receptacles spaced as shown in the illustration. The receptacles were constructed of 1-in. (2.5-cm.) wrought-iron pipe welded to a point at the end which entered the coal pile. The exposed end was fitted with a self-closing cap to prevent the entrance of any substance which might interfere with the ready insertion of the pyods. Fifteen pyods were purchased. These were portable. The wiring to the engineer's office, however, was of a permanent nature from a central location on the coal pile. From this point lines radiated to the portable pyods.

The pyod receptacles were numbered 1 to 15 on each row, which had a distinguishing letter as shown in the accompanying illustration. The switches in the engineer's office were numbered and lettered in a manner to correspond with the pyod receptacles. This plan permitted an attendant to place the pyods in the desired receptacles and the engineer to observe and record in the station log, in numerical order, the temperature readings of the coal at the different points. After placing the last of the pyods in row A, the attendant immediately commenced transferring them to row B in numerical sequence. The time elapsing between the insertion of the first and the fifteenth pyod was considered sufficient for the pyod to adjust itself to the various temperatures encountered inasmuch as the temperature to be measured already existed in the pockets formed by the pyod receptacles. Thus an unbroken operation can be carried out in the shortest possible period of time. After the temperature existing in the last pyod receptacle was read all the pyods were transferred to centrally located receptacles, as it was assumed that this would be in the vicinity of the greatest possible heat generation, inasmuch as they are the furthest removed from the cooling effect of the air.

If desired, a recording pyrometer can be installed in conjunction with the indicating instrument.



PLAN SHOWING SPACING OF PYOD RECEPTACLES—ABOVE. SECTIONAL ELEVATION OF COAL PILE WITH TEMPERATURE MEASUREMENT APPARATUS IN PLACE.

Kansas City Plans for Reducing Power Shortage

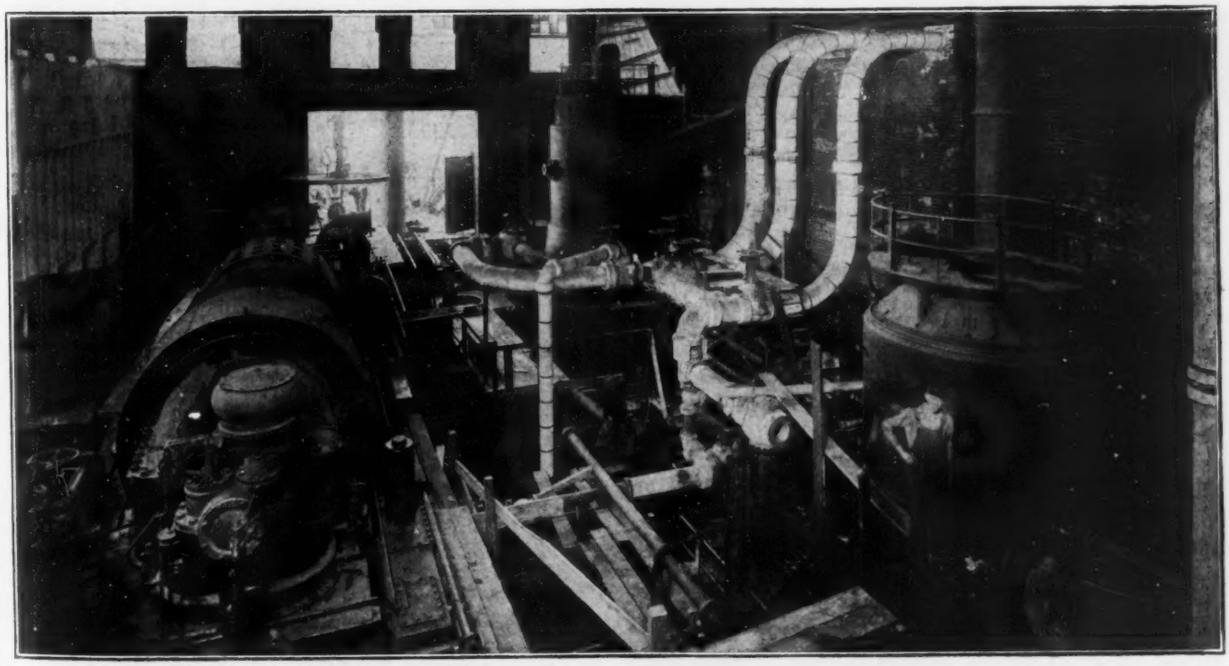
Additional Equipment Costing $1,250,000 Installed to Render Temporary Service Until New Plant Can Be Put in Operation—Company Succeeds in Getting Turbines in Cleveland and Boston—A Total of 15,000 Kw. Is Added to Rating of Station

BY MUCH hard work Kansas City, Mo., will have available 15,000 kw. more power in the winter of 1918-19 than in the winter of 1917-18. Last year the peak load on the power house of the railway company, which supplied energy for light and power as well as transportation, was 52,000 kw. The demand for energy was so great, however, that as much as 17,000 kw. of load actually on the lines had to be dropped on some days solely because there was not power enough to supply all users. So it appears that while the company has made an extraordinary effort to install equipment to take care of this added business, it may be necessary at times again to effect an agreement with power users to stay off the company's lines during the peak-load period.

The changes and additions made to the company's plants in order to have available more energy for customers until the company's new 50,000-kw. plant is placed in service are the more interesting because they represent an expenditure of $1,250,000 laid out purely in the interest of providing temporary service to customers. When the power shortage came the Kansas City Light & Power Company had, in addition to the energy which it was purchasing from the railway company, a station at Central Avenue and Water Street and one at Baltimore Avenue and Thirteenth Street. The equipment in the Central Avenue station consisted of two 1500-kw. engines driving 25-cycle generators. The building in which this equipment was installed was fortunately not all occupied by machinery. It was also fortunate that the company had under contract four 550-hp. and four 750-hp. Stirling boilers. As a part of the emergency work a new boiler house was built adjacent to this central Avenue station and arrangements were made to set additional generating equipment in the existing engine room. From the Boston Edison company the Kansas City company then purchased one 3500-kw. General Electric Company 25-cycle turbine. Another second-hand vertical turbine, rated at 9000 kw., 60 cycles, was procured in Cleveland. In addition the company was able to obtain delivery on one 1500-kw. low-pressure Westinghouse horizontal 60-cycle turbine with auxiliaries. Thus even in the stringent market generating machinery was purchased and shipped to Kansas City.

Then the real rush and scramble began, for it was necessary to install all of this equipment in the existing station while it was in operation. Moreover, while it was probable that the installation would not be in service more than perhaps three years, the equipment had to be installed as well as if it were being placed for operation over a period of twenty years. This meant that new water intakes and discharges, new screens and wells, new coal-handling equipment, feeders and switchboards all had to be added to the plant.

At the same time one 2000-kw. Allis-Chalmers turbine, one 250-kw. direct-current engine unit and two 1500-kw.



NEW CONSTRUCTION UNDERTAKEN TO REDUCE POWER SHORTAGE

Central Avenue station of the Kansas City Light & Power Company, showing in the foreground a 1300-kw. low-pressure turbine. Alongside of this unit and to the right is a 3500-kw. vertical turbine, and at the rear stands a 9000-kw. turbine. In close proximity to the 1500-kw. low-pressure unit is a section of bus structure, and to the left of it is a section of vertical bus structure which takes care of all of the new installations.

General Electric turbines in the Baltimore Avenue station had to receive a thorough overhauling to be sure that they would stand up under the strain of the coming winter peak. With this work accomplished the management of the company is of the belief that it will have enough additional equipment to carry 15,000 kw. more load than the company could take care of last winter.

A study of the economics of installation of temporary equipment may be interesting because both the new and the second-hand equipment were bought in a market where demand exceeded the supply by an unprecedented figure. Moreover, some of the generating equipment bought will probably be of little service after it has served its temporary usefulness in Kansas City, because it is now somewhat obsolete. However, the boilers will no doubt be found useful in other locations after the Central Avenue plant has been abandoned in favor of the company's new station on the Missouri River. Hence, while the generators will have to pay for themselves in the period during which Central Avenue station is operated, the investment in the boilers can be spread over a longer period. How long this period of operation will be is as yet a matter of conjecture, but it is thought that it will not be long, as the schedule calls for the starting of the company's first 25,000-kw. units in its new station in the spring of 1919.

Disarm the Lawless Hun—Buy Bonds

MAN POWER SAVED BY REMOTE CONTROL OF SUBSTATIONS

Saving in Expense of Attendance Soon Pays for Increased Cost—No More Trouble than When Operators Are Present

W. T. Snyder, electrical engineer for the National Tube Company, McKeesport, Pa., pointed to a year of successful operation of a remote-controlled substation, at the annual convention of the Association of Iron and Steel Electrical Engineers, in a paper entitled "Remote-Controlled Substations."

Mr. Snyder made the statement that push-button control of oil switches and motor-operated rheostats permit the generating plant attendant to control the motor-generator sets in the substation which is locked up and unattended except for the daily inspection. Ammeters and voltmeters at the generating plant give the operator there all the information necessary for starting and loading the substation. The writer states that the remote-control feature added about 10 per cent to the cost of the substation. This increase in fixed charges should be readily wiped out by saving in operating expense, in addition to conserving labor for other purposes. A great saving in copper was effected in the direct-current system by locating the substation near the load center.

The paper was discussed by C. S. Lanckton, H. C. Crank, D. M. Petty and C. A. Menk. In reply to questions, Mr. Snyder said that the substation had been in operation for about a year and that no changes had resulted excepting that solenoids had been replaced by motors for rheostat control. He preferred the remote-control scheme to a full automatic substation and said that two more motors are to be installed soon.

PRACTICAL DATA UPON ELECTRIC SPOT WELDING

Power Consumption, Strength of Welds and Speed with Which Welds Can Be Made Determined for Various Kinds of Plates

BY G. A. HUGHES AND R. H. POOL
Electrical Engineer and Assistant, Truscon Steel Company
Youngstown, Ohio

TO DECIDE whether it is better to rivet or to spot-weld an article one must take into consideration the use of the article and must not base his decision on the cost of obtaining a desired strength. In light work spot welding can successfully replace riveting in 90 per cent of the cases. There are numerous conditions where it is impossible to use rivets because the stock will not permit the punching of the hole or because the rivet head is objectionable. Special spot-welding machines can be made to take care of the difficult shapes and thus reduce the cost of an article in the saving of the rivets and dies, maintenance of dies and labor in laying out and punching the stock.

An ideal condition for spot welding is where a smooth surface is desired and the material does not permit the countersinking of the rivet heads. But spot welding is not confined to the sheet-metal industry alone. Structural steel can be successfully welded. In fact, it is

TABLE I—DATA OBTAINED USING THREE $\frac{1}{16}$-IN. PLATES

Volts	Amp.	Kw.	P.F.	Size of Spot, In.	Condition of Materials	Tap of Auto-Transformer	Time in Seconds
232	186	17.6	0.41	$\frac{1}{4}$	Free from rust	5	44
232	176	18.4	0.45	$\frac{1}{4}$	Free from rust	5	42
232	180	18.1	0.43	$\frac{1}{4}$	Free from rust	5	44
230	256	25.6	0.43	$\frac{1}{4}$	Free from rust	7	30
230	248	24.0	0.42	$\frac{1}{4}$	Free from rust	7	31

TABLE II—DATA OBTAINED USING TWO $\frac{1}{16}$-IN. PLATES

Volts	Amp.	Kw.	P. F.	Time in Seconds	Tap of Auto-Transformer	Condition of Material
218	208	26.4	0.57	24	7	Scale and rust were present
218	224	26.0	0.53	22	7	
218	224	26.4	0.53	24	7	
218	228	26.8	0.54	22	7	
218	216	26.0	0.55	22	7	
218	224	26.4	0.54	26	7	
218	220	25.5	0.53	25	7	
218	224	28.0	0.57	22	7	

TABLE III—DATA WITH DIFFERENT MATERIAL

Volts	Amp.	Kw.	P. F.	Material Used	Time, Seconds	Tap of Auto-Transformer	Size of Spot, In.
220	244	24	0.54	Two $\frac{1}{16}$-in. mild-steel plates	15	7	$\frac{1}{4}$
220	260	20	0.35	Two $\frac{1}{16}$-in. Vasco non-shrinkable steel plates	20	7	$\frac{1}{4}$

TABLE IV—COMPARISON* OF SPOT-WELDED AND RIVETED JOINTS

Test No.	Size of Spot, In.	Condition of Sheets and Contacts	Maximum Load, Lb.	Nature of Failure	Number of Spots
1	$\frac{1}{4}$	Free from scale. Contacts good	4,460	Welds pulled out	1
2	$\frac{1}{4}$	Free from scale. Contacts good	7,250	Welds pulled out	2
3	$\frac{1}{4}$	Free from scale. Contacts good	10,920	Welds pulled out	3
4	$\frac{1}{4}$	Scale on sheets. Contacts poor	4,400	Welds sheared	2
5	$\frac{1}{4}$	Rust and scale. Contacts good	8,100	Welds sheared	3
6	Two-$\frac{1}{4}$-in. rivets, holes drilled and rivets inserted with care		4,700	Rivets sheared	..
7	Two-$\frac{1}{4}$-in. rivets, holes drilled and rivets inserted with care		5,200	Rivets sheared	..

* All tests were on No. 14 gage sheets, steel 3 in. wide, single lap-joint, single-shear.

being used in shipbuilding to advantage. The question that arises is, "What is the greatest thickness of material that can be successfully welded?" The thickness of material will depend entirely upon its size and shape, together with the rating of the welding machine. The writer has seen two pieces of ½-in. (1.27-cm.) material—a total thickness of 1 in. (2.54 cm.)—welded on a 30-kw. machine.

TABLE V—TENSION TESTS ON SPOT-WELDED JOINTS

Test No.:	1	2	3	4	5	6	7	8
Maximum load, lb.	3,700	3,740	6,470	6,195	4,980	4,980	7,830	7,790
Nature of failure	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Plate failed	Plate failed
Number of spots	1	1	1	1	2	2	2	2
Kind of joint	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear

Material tested—No. 16 gage sheets, 3 in. wide; welds ⅜ in. spots.

The data are intended to give an idea of (1) power consumption, (2) strength of the weld, and (3) speed at which welds can be made All the tests on which the data are based were made on 30-kw., 220-volt, 60-cycle hand-operated machines made by the Federal Welding & Machine Company of Warren, Ohio. Fig. 1 shows its standard 449-B machine, and Fig. 2 its special heavy-duty machine. The machines were in service for two hours before the tests were made. This was to allow for the heating of the machines. Each machine had an auto-transformer in the primary circuit of the welding transformer to control the welding current. Taps were provided on the auto-transformer to adjust the primary voltage in eight steps from 65 per cent to full-line voltage.

In making the test recorded in Table I three plates of soft steel $\frac{3}{16}$ in. (4.8 mm.) thick were used, making a total thickness of $\frac{9}{16}$ in. (13.2 mm.). The first three welds were made with the auto-transformer on tap 5. The time of welding varied from forty-two to forty-four seconds and the power demanded from 17 kw. to 18.4 kw. The fourth and fifth welds were made with the auto-transformer on tap 7. The time of welding was thirty to thirty-one seconds and the power demanded 24 kw. to 25.6 kw. All of the welds were satisfactory. (Note the power factor.) An attempt was made to weld on tap 8, but this was unsuccessful as the material next to the copper contacts would become hotter than the center plate and would be forced out from under the contacts and thus burn the material at point of weld.

An attempt was made to determine the proper pressure for the contacts while welding, since the presence of the scale and rust caused considerable arcing and burning of the material under the contacts, forcing the molten metal out and thus leaving a bad weld, although it would have the appearance of a perfect one. Upon cutting into the weld, however, it would have the appearance of a honeycomb. To avoid this trouble it was decided first to burn the rust and scale off. This was accomplished by forcing the welding contacts firmly on the material and then turning the power on the welder for a moment. This method removed the scale and assured a good contact between the welding points and the material. Then the power was turned on and the material brought up to a welding heat without arcing. This saved the cleaning of the stock and added about 50 per cent to the life of the welding points.

To determine the kilowatt-hours consumed in a day's run an integrating watt-hour meter was installed. Some conclusions made from these readings are given:

1480 welds of two pieces No. 18 gage sheet steel.
1050 welds of four pieces No. 16 gage and one piece $\frac{1}{16}$-in. plate.

2530 welds total in ten hours. Energy consumed, 42 kw.-hr.

680 welds of two pieces No. 18 gage sheet steel.
1350 welds of four pieces No. 16 gage and one piece $\frac{1}{16}$-in. plate.
545 welds of one piece of No. 18 gage and one piece of ¼-in. mild steel.

2575 welds total in ten hours Energy consumed, 35 kw.-hr.

In making the tests indicated by Table III it was

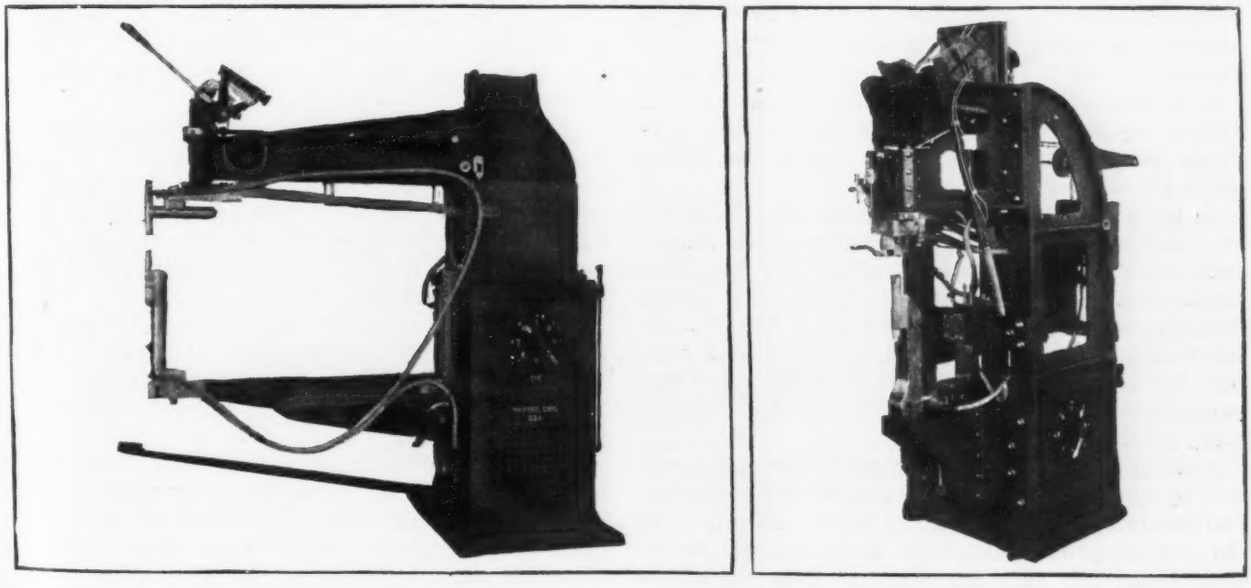


FIG 1 AND 2—STANDARD AND HEAVY-DUTY SPOT-WELDING MACHINES

impossible to obtain two results alike owing to the different chemical analyses of the steel.

The number of welds made in a ten-hour period was not large owing to the nature of the material, it requiring three men to handle the work and one man to operate the machine. The result of tension tests on spot welding are given in Tables IV and V. Table IV compares the use of ¼-in. rivets and spot welding.

Experience with Pulverized Coal

Comparison with Stoker Firing—Uniform Performance and Efficiency Possible—Can Utilize Low-Grade Fuels Economically—How Difficulties Were Overcome in the Plant of a Milwaukee Utility Company

IN AN effort to determine the advisability of utilizing pulverized fuel in its plants, the Milwaukee Electric Railway & Light Company early in 1918 decided upon a trial installation at the Oneida Street station. The necessary equipment for preparing and feeding the coal was installed and the boiler was placed in service during the early part of May. From that time until early in August, when the installation was finally proved successful, changes were made to eliminate undesirable conditions encountered during preliminary operation.

Drying and Pulverizing Equipment

The drying and pulverizing equipment, installed in a room near the plant coal bunkers, consists of one 15-ton-per-hour indirect-fired dryer and one 4-ton-per-hour pulverizer. From one of the coal bunkers the fuel as delivered to the plant is carried to the dryer supply bin by means of a screw conveyor and bucket elevator. From this supply bin the coal is drawn into the drying cylinder by means of another screw. It is carried through the dryer by means of gravity and discharged into an elevator which carries the dried fuel to the pulverizer supply bin. In the dryer the moisture is reduced from 11 per cent to 1 per cent at the rate of about 10 tons per hour.

In passing to the pulverizer supply bin the coal is run over a magnetic separator pulley which removes such iron and steel as has been carried that far. From the bin last mentioned the fuel is fed to the pulverizer through a small screw conveyor on top of the mill. Being driven from the mill shaft by means of a small belt, this screw can be varied in speed through a cone pulley arrangement to allow for the kind of material being powdered.

After passing through the pulverizer the fuel is carried by means of a screw conveyor to the pulverized-fuel storage bin in front of the boiler. All drives on the conveying and pulverizing equipment are so arranged that only such machinery as is in use will be operating.

The equipment for firing the fuel into the furnace consists of a blower and two screws driven by variable-speed motors. The screws, at the base of the powdered coal bin, carry the coal at a uniform rate to the feeder pipes, where it is thoroughly mixed with air by means of agitator wheels attached to the end of the screw shafts. From the paddlewheel the fuel is carried into the furnace by the air blast supplied from the blower. The furnace is of the Dutch-oven type so as to insure the proper flame travel, thus preventing destruction to the brickwork.

When the boiler was first put into operation a number of undesirable conditions resulted. An insufficient air supply caused high furnace temperatures. These temperatures caused fusion of the ash particles and a consequent accumulation of slag between the tubes, on the furnace walls and in the ash pit. The removal of the molten slag presented a rather difficult proposition. It was also found that the combustion chamber was of insufficient size. High gas velocities resulting from insufficient air tended toward destruction of the refractory surfaces of the furnace.

A new furnace was therefore designed. The combustion chamber was enlarged, and a regulated air supply was provided for by means of a number of auxiliary air openings equipped with dampers. The accumulation of slag in the pit was prevented by raising the point of admission of the fuel into the furnace. As a result the flame path was raised above the base of the pit; hence particles of ash dropping from the flame are not fused. The ash can therefore be drawn from the pit in the form of a powder and small slugs of slag. Analysis has shown that the ash contains practically no carbon.

Having established satisfactory furnace operating conditions, a series of efficiency and capacity tests were conducted to prove contract guarantees. The brickwork was then given a thorough trial by carrying the boiler at a continuous rating of 180 per cent over a period of several days. A final efficiency test, the results of which are published herewith, followed.

The boiler is an Edge Moor three-pass water-tube boiler, equipped with a superheater and vertical baffles. The coal feeders and burners are of the "Lopulco" type, manufactured by the Locomotive Pulverized Fuel Company of New York.

Because of the nature of the equipment the coal could not be weighed on the firing floor. To arrive at exact coal figures, it was necessary to run all drying and pulverizing equipment free of coal. The fuel in the pulverized storage bin was run to as low a level as possible and a measurement taken to determine the cubical contents of the powdered coal on hand at the start. Coal for the test run was then weighed into the system at the moist coal bunker. At the close of the run the starting conditions so far as was possible were again established. The samples for analysis, upon which the test results are based, were taken at the moist coal bunker as the coal was weighed in. Moisture samples were also taken at the pulverizer feeder and the burners. All analyses were made at the laboratories of the Milwaukee company.

The feed water used during the test was weighed on

the standard tank scales of 2000 lb. (907 kg.) capacity each. All feed-pump gland leakage was accounted for in the way usually adopted on standard boiler tests.

All temperatures and pressures were taken with instruments which previous to the test had been checked against standard instruments. The blow-off piping on the boiler was disconnected so as to insure against any possible loss of water. Flues were blown five times during the twenty-four hours.

Flue gas analyses were determined by means of an Orsat apparatus.

Throughout the test very uniform conditions were maintained. The speed of coal feeders and the drafts carried were held constant. The feed-pump speed had to vary somewhat from time to time. The variation in the rate of evaporation was, however, due to slight changes in the quality of coal during the test run.

PULVERIZED COAL VERSUS MECHANICAL STOKERS

1. Under this heading fuel-preparation costs will be considered first. In the case of powdered coal this information can be classed under three general divisions:

(a) The cost of crushing the coal. This expense is the same for both types of equipment.

(b) The cost of drying and pulverizing the coal. Although no cost records are available at present, it is estimated that 32 cents per ton will cover this preparation cost in a 200-ton-per-twenty-four-hour plant using bituminous coal containing about 12 per cent moisture.

(c) The maintenance cost of the drying and pulverizing plant. This unit has not been determined from actual experience; however, it is estimated that 3 cents per ton will cover the maintenance. In stoker practice the maintenance cost per ton of fuel fired is close to 5 cents.

Summarizing the above facts, it is evident that, with fuel at $5 per ton, the gross efficiency shown by the pulverized-fuel boilers will have to exceed that shown by the mechanical-stoker-fired boilers by 6 per cent in order to offset coal preparation costs. A 6 per cent deduction from a gross efficiency of 85 per cent gives a net efficiency of 79 per cent for the powdered coal burner. In stoker practice the maximum attainable gross efficiency at any of the Milwaukee electric plants has been 80.54 per cent. Deducting 2.5 per cent for auxiliary uses, the resulting net efficiency is 78 per cent, which is lower by 1.1 per cent than the figure obtained in pulverized-fuel practice.

Other advantages resulting from the use of pulverized fuel are summarized herewith:

2. Continuous boiler operation at a uniform rating as well as a constant efficiency is made possible. At no time is there a loss in capacity due to the clinkering of coal on the grates or the cleaning of fires.

3. Heavy overloads can be taken on or dropped off in a very brief time through adjustment of the coal feeders and the furnace drafts.

4. From 97 to 98 per cent of the combustible in the coal is utilized, regardless of the quality of the fuel.

5. The ash-handling costs are reduced to a minimum owing to the reduced volume.

6. The banking conditions when operating with pulverized fuel are somewhat different from those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets a boiler can be held up to pressure for about ten hours. The furnace brickwork, having been heated to incandescence during operation, gives off radiant heat which is absorbed by the boiler rather than sent out through the stack.

The ease of controlling the fuel, feed and drafts, the ability to take on heavy overloads in a brief time, the thorough combustion of the coal and the uniform high efficiency obtainable under normal operation make pulverized coal a most satisfactory form of fuel for central-station uses.

The full story of maintenance expense is only partly known to us as yet. Indications are that no unusual difficulties will be met. The cost of fuel preparation and labor for operating a boiler room fully equipped with pulverized-coal-burning boilers will be a question for the engineer to decide for himself according to his particular conditions. Properly installed with respect to capacity of storage, size of dryer and pulverizers, and on a sufficient number of boilers properly and fully to employ the minimum number of men, the pulverized-fuel installation will most undoubtedly be more advantageous.

The chief items that must be borne in mind by engineers are the ease with which a high efficiency is obtained and the constant nature of that efficiency as compared with the absence of these advantages in a stoker-fired boiler, unless very closely supervised. There is no doubt that with a well-equipped plant burning pulverized fuel having all the necessary recording and indicating instruments to guide the operators in maintaining the proper conditions, a lower cost of generating steam will be possible than has heretofore been the case with any other style of equipment.

LOG OF OFFICIAL TEST AT ONEIDA STREET STATION

Heating surface, sq.ft.	4,685
Temperature of feed water (deg. Fahr.), average	157.2
Temperature of steam (deg. Fahr.), average	448.7
Temperature of flue gases (deg. Fahr.), average	495.3
Average boiler pressure	167.0
Fuel (100 per cent bituminous coal) fired per hour, lb.	1990.6
Water apparently evaporated per hour lb.	16,392.0
Water apparently evaporated per lb. of coal, lb.	8.23
Factor of evaporation	1.1502
Water evaporated from and at 212 deg. Fahr., per lb. of coal, lb.	9.47
CO_2, per cent average	13.85
O, per cent average	4.38
CO	None
Fuel Analyses:	Average, Per Cent
Moisture	10.49
Volatile	35.96
Fixed carbon	49.53
Ash	15.93
Sulphur	2.04
B.t.u., as received	10,779
B.t.u., dry	12,045
Accumulation of slag on tubes	None
Condition of smoke	Light
Heat effect on brick	None
Backlash of flame in burner	None
Lb. steam per hour	16,390.3
Lb. steam per hour from and at 212 deg. Fahr.	18,842.6
Per cent of rating	116.7
Boiler efficiency	85.22
(Flues blown five times during test.)	
Fuel Preparation Deductions:	
Coal used in dryer, lb.	1,140
Kilowatt-hour motor operation (449.3), coal equivalent at 3 lb. per kw.-hr.	1,348
Total deduction, lb.	2,488
Resulting net efficiency (per cent)	81
No deduction made for stand-by losses in dryer.	

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FLASHLAMP SUITABLE FOR USE AS TESTING DEVICE

Can Be Used with Good Results to Trace Circuits, to Test Continuity of Fuses and for Other Similar Purposes

BY T. H. REARDON

Flashlamps, which are usually carried by electrical inspectors, can be utilized to test fuses and trace circuits when other means are not available. For such use it is easiest to employ a flashlamp the battery of which is accessible from the end opposite the lens. The cap on this end should be removed so that one end of the fuse to be tested can be pressed against the bottom of the battery. If connecting the other ends of the fuse and the metal ring on the flashlamp case with the handles of pliers lights the lamp, the fuse is perfect. Plug and cartridge fuses can be tested in the same way.

Coils of wire, etc., not having too high resistance, can also be tested for continuity, and circuits can be traced by using the flashlamp battery as the source of energy and the lamp as the signal.

Stop Boche Brutality—Buy Bonds

ISOLATING HIGH-TENSION CABLES IN SUBSTATIONS

Leads Brought to Apparatus in a Cored Wall—Switches Placed in Compartments and Separated by Firebrick or Sandstone Slabs

In order entirely to isolate failures in high-tension cables, a central-station company in the Middle West is building all of its substations with a standard cored wall with winged compartments. This method of building the cored wall with ducts in the brick involves skill and entails labor upon the bricklayer, but the company believes that it is justified because it absolutely prevents a failure in one line from spreading to the next. All of the switching apparatus and meter transformers are installed in this double-winged wall. The wings are 3 ft. (1.22 m.) deep, their width depending upon the size and type of the apparatus. The brick separations are one brick wide, whereas the smaller divisions are made by inserting, as needed, sandstone barriers 1½ in. (3.8 cm.) thick. In one main compartment are the three lines of a three-phase circuit, these being completely isolated by a 1½-in. (3.8-cm.) sandstone slab. Each compartment is inclosed by means of an asbestos board door hung from the top of the compartment. This is done so that in case of accident the gases will escape and the force of the explosion spend itself without endangering the remainder of the structure. The entire structure is arranged on two or three floors with the transformers, oil switches, disconnecting switches and instrument transformers installed in the most convenient manner.

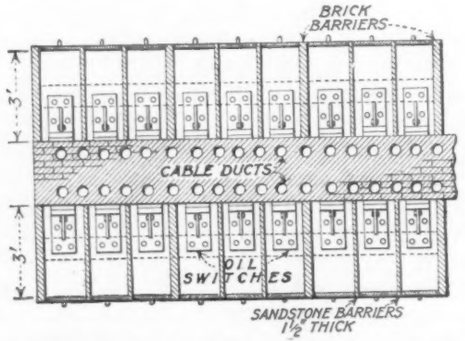


FIG. 1—MINOR BARRIERS ARE SANDSTONE AND HINGED DOORS OF ASBESTOS BOARD

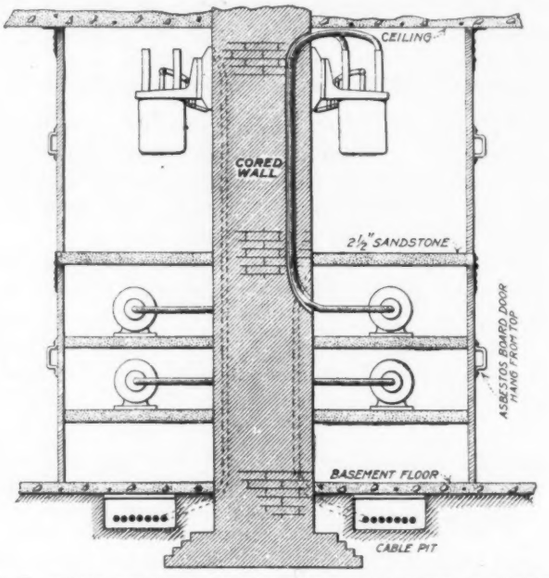


FIG. 2—PLAN SHOWING MAIN WALLS AND WINGS OF BRICK—CABLES ARE WELL ISOLATED

Remember Brest-Litovsk—Buy Bonds

A PLACE FOR GAS ENGINES IN ELECTRICAL SYSTEMS

Additional Power at Small Expense by Driving Existing Motor-Generators and Synchronous Condensers by Internal-Combustion Engines

In many electric service systems there are frequency changers or synchronous condensers at various points that might be utilized to help carry increased loads without much additional investment, says Henry M. Trench, a construction engineer. Since these units are

usually situated at the tie-in points between systems or at centers of distribution, the conditions are almost ideal for their operation as generators. To permit this little additional equipment is needed besides some internal-combustion engines (gas or oil, depending on which is more convenient to use) to drive the units.

Where such machines are installed a clutch or other mechanical connection may be inserted between them and the internal-combustion engine so that they may be engaged or disengaged as conditions require. With this arrangement the units may be used for their original purpose or as generators whenever desired. The engine attached to a motor-generator should be rated at the combined capacities of the motor and generator so that both may be driven as generators. Starting of such reserve plants could be made automatic if desired, since power would always be available to start the outfits from the generator end.

Free the German Slaves—Buy Bonds

ACTUAL CONSTRUCTION COST OF INDUSTRIAL SUBSTATION

Data Refer to a Semi-Outdoor Installation Rated at 600 Kva.—Energy Is Received at 22,000 Volts and Delivered at 2300 Volts

The following data cover the actual cost of construction of a 600-kva. industrial substation of the semi-outdoor type on the line of the Eastern Massachusetts Electric Company, interconnecting the properties of C. H. Tenney & Company in the Boston-Salem district. The substation is served by a three-phase line which is dead-ended on strain insulators bolted to wooden poles tied together by angle-iron and channel-iron braces. Taps from the incoming leads are run to air-brake switches, choke coils and fuses, from which connections are made to a transformer bank housed in a structure at one side and containing low-tension switching and metering equipment. The incoming line is operated at 22,000 volts, and energy is delivered to the customer at 2300 volts. The lightning arresters are of the outdoor type.

COST OF SEMI-OUTDOOR SUBSTATION

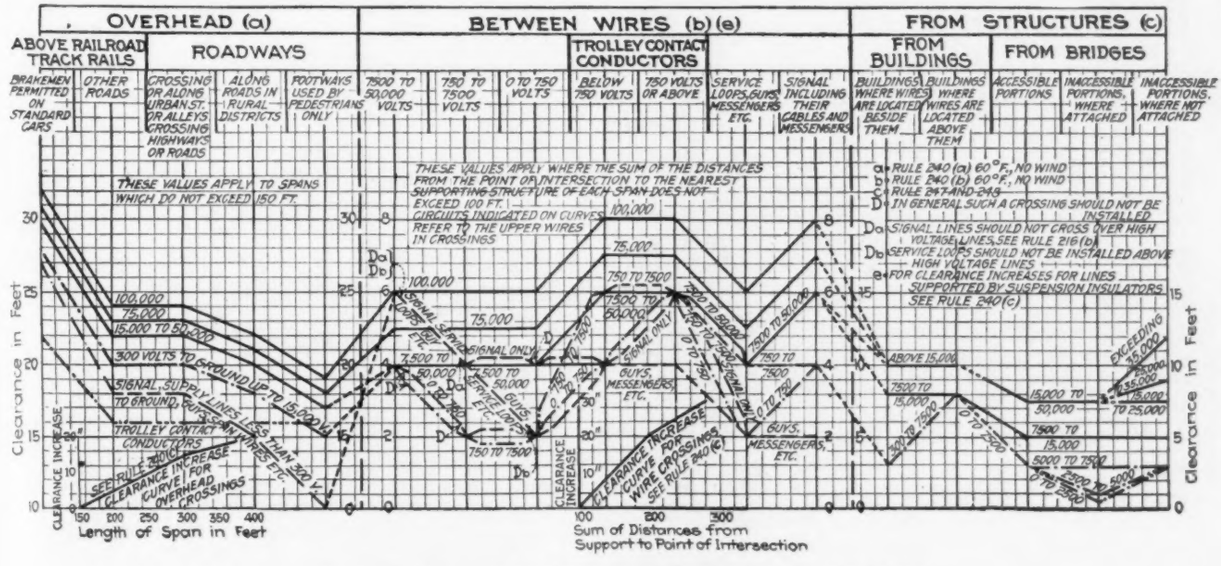
Structures and foundations, including engineering services, $59.72		$533.88
Transformers:		
Three 200-kva., 22,000/2300-volt transformers, oil-cooled, outdoor type	$1,675.16	
Freight on above	82.43	
620 gal. H. F. oil	132.00	
Engineering expenses	390.70	
Miscellaneous items	269.62	
		3,549.91
High-tension arresters, switches, etc.:		
One 22,000-volt, 300-amp. vertical air-break disconnecting switch	$121.00	
One 10-ft. outdoor switch stick	8.62	
One 22,000-volt liquid electrode lightning arrester, three-phase service	443.50	
Three 200-amp., 22,000-volt choke coils and three 25-amp., 22,000-volt fuses	105.30	
Three 25-amp., 22,000-volt fuse holders	54.00	
Porcelain insulators, suspension eyes, hooks, pins, bushings, etc.	90.63	
Freight and expressage	48.70	
Miscellaneous	141.57	
Engineering services	139.34	
		1,152.66
Miscellaneous materials		106.12
Low-tension control:		
One slate panel, 38 in. by 24 in. by 2 in., complete with 300-amp., 2500-volt trip oil switch, polyphase watt-hour meter, two current transformers and two potential regulators	$310.00	
Floor flanges, U-bolt fittings, clamp crosses, terminal lugs, connectors, etc.	45.46	
Miscellaneous supplies, etc.	98.62	
Engineering service	59.72	
		513.80
Labor and installation:		
Labor and expenses associated, including engineering service, $159.24		1,395.88
Total		$7,252.25
Cost per kva.		$12.09

End German Cruelty—Buy Bonds

CHART WHICH GIVES WIRE CLEARANCES NECESSARY

Affords Ready Means for Ascertaining Clearances Needed Between Wires Over Crossings and from Adjacent Structures

Information regarding the wire clearances necessary over any highway, from wires operating at different voltages and from adjacent structures, can be readily obtained from the accompanying chart. This refers to minimum clearances required and is indicative of material which will be included in the supplement to the National Electrical Safety Code, now being revised.


OVERHEAD (a)
BETWEEN WIRES (b) (c)
FROM STRUCTURES (c)
ABOVE RAILROAD TRACK RAILS
ROADWAYS
TROLLEY CONTACT CONDUCTORS
FROM BUILDINGS
FROM BRIDGES
BRAKEMEN PERMITTED ON STANDARD CARS
OTHER ROADS
CROSSING OR ALONG URBAN ST. OR ALLEYS CROSSING HIGHWAYS OR ROADS
ALONG ROADS IN RURAL DISTRICTS
FOOTWAYS USED BY PEDESTRIANS ONLY
7500 TO 50,000 VOLTS
750 TO 7500 VOLTS
0 TO 750 VOLTS
BELOW 750 VOLTS
750 VOLTS OR ABOVE
SERVICE LOOPS, GUYS, MESSENGERS ETC.
SIGNAL INCLUDING THEIR CABLES AND MESSENGERS
BUILDINGS WHERE WIRES ARE LOCATED BESIDE THEM
BUILDINGS WHERE WIRES ARE LOCATED ABOVE THEM
ACCESSIBLE PORTIONS
INACCESSIBLE PORTIONS, WHERE ATTACHED
INACCESSIBLE PORTIONS, WHERE NOT ATTACHED
THESE VALUES APPLY TO SPANS WHICH DO NOT EXCEED 150 FT.
THESE VALUES APPLY WHERE THE SUM OF THE DISTANCES FROM THE POINT OR INTERSECTION TO THE NEAREST SUPPORTING STRUCTURE OF EACH SPAN DOES NOT EXCEED 100 FT.
CIRCUITS INDICATED ON CURVES REFER TO THE UPPER WIRES IN CROSSINGS
a RULE 240 (a) 60°F., NO WIND
b RULE 240 (b) 60°F., NO WIND
c RULE 247 AND 249
D IN GENERAL, SUCH A CROSSING SHOULD NOT BE INSTALLED
SIGNAL LINES SHOULD NOT CROSS OVER HIGH VOLTAGE LINES, SEE RULE 216 (b)
SERVICE LOOPS SHOULD NOT BE INSTALLED ABOVE HIGH VOLTAGE LINES
FOR CLEARANCE INCREASES FOR LINES SUPPORTED BY SUSPENSION INSULATORS SEE RULE 240 (c)
100,000
75,000
15,000 TO 50,000
300 VOLTS TO GROUND, UP TO 15,000 V.
SIGNAL SUPPLY LINES TO GROUND, BUT NOT ANY WIRES ETC. OVER 300 V.
TROLLEY CONTACT CONDUCTORS
SEE RULE 240 (c) CLEARANCE INCREASE CURVE FOR OVERHEAD CROSSINGS
7500 TO 50,000
750 TO 7500
0 TO 750
SIGNAL ONLY
GUYS, MESSENGERS ETC.
CLEARANCE INCREASE CURVE FOR WIRE CROSSINGS SEE RULE 240 (c)
ABOVE 15,000
15,000 TO 50,000
15,000 TO 25,000
EXCEEDING 35,000
5000 TO 7500
0 TO 5000
Clearance in Feet
CLEARANCE INCREASE
Length of Span in Feet
Sum of Distances from Support to Point of Intersection

MINIMUM CLEARANCE REQUIRED UNDER DIFFERENT CONDITIONS

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

UTILITY'S SAFETY WORK OF LARGE PUBLIC GOOD

Lives of Non-Employees Are Saved as the Result of the Commonwealth Edison Company's Training in Resuscitation

For more than five years the safety organization of the Commonwealth Edison Company has labored effectively to prevent accidents to persons and property. It has not only been succeesful in this work so far as the company itself is concerned but the training received by employees has in several instances been the means of saving the lives of persons not connected with the company. This is especially true of the employees of the street department of the company, whose work takes them out on the street. However, every employee whose duties require him to work on or near "live" wires is instructed weekly in the Schaefer method of resuscitation and is examined periodically for proof of his fitness.

Not long ago the Edison men showed what they could do in a drowning accident. A ten-year-old girl fell into Lake Michigan not far from where a force of linemen connected with the southern district of the street department of the company happened to be working. Without hesitation one of the men leaped into the water, reappearing a moment later with the apparently lifeless body of the child. The little girl was quickly brought to the shore, and the foreman of the men immediately applied the prone method of resuscitation. In a few minutes there were signs of life. By evening it was reported from the hospital where the child was later taken that she had fully recovered.

In more than one instance Edison employees have made convincing demonstrations of the value of their first-aid knowledge in the case of persons overcome by gas. In one case seven of the men of the northern district of the street department were instrumental in saving the lives of two employees of the People's Gas Light & Coke Company of Chicago, the latter having been overcome by gas while working in a manhole. The Edison linemen were working near by when they received word that two men were lying unconscious in a manhole. They quickly raised the victims to the surface of the street and put in practice at once the Schaefer method of artificial respiration. After about thirty minutes of this work two doctors arrived on the scene, and there was a discussion whether the men should be removed to a hospital or the artificial respiration should be continued. In accordance with the rules of the company, the foreman insisted that his men be allowed to continue with their methods, and this course was followed. After about an hour's work the persevering rescuers were rewarded, the patients giving unmistakable signs of life. The sufferers from the accident, after thus being started on the road to recovery, were removed to a hospital.

Thus the teachings of the safety organization of the company have saved the lives of outsiders, while they have also reduced the number of accidents in the Commonwealth organization to a very marked degree. The safety work is carried on through various committees, the most important being a central committee on safety, coöperating with the bureau of safety, which does safety work over a wide geographical area. The administrative work of the safety movement is carried out under the direction of an inspector of safety and fire prevention.

The Commonwealth Edison Company is one of the holders of the gold medal awarded by the American Museum of Safety to American employers conspicuous in the successful execution of methods and plans for the safety of employees.

Freedom Shall Live—Buy Bonds

EMPLOYMENT OF WOMEN IN STOCK-ROOM POSITIONS

Details of Uniform So Designed that the Woman Worker Will Look as Inconspicuous as Possible

In a paper read at the recent convention of the New England Section of the National Electric Light Association, W. F. Stevens, head of the supply department of the Edison Electric Illuminating Company of Boston, described the use of women in the company stock room. Beginning eighteen months ago, when men left for war service or higher wages, their places were filled largely with boys, men about fifty years of age and women. It was found that the boys as a rule were dissatisfied with the wages, while the older men could not readily meet the physical requirements besides being slow in learning. Women at first were unsatisfactory through their finding it difficult to adapt themselves to the conditions of work in the department, but gradually this disadvantage was overcome and some changes in methods were made which facilitated their new duties. It was not difficult to replace men with women in purely clerical positions, but in stock-room work it was not easy to find women who had sufficient physical strength, education and mentality or desire to learn the work.

Experience showed the necessity of adapting the conditions of work to the women. The company finds that young women with good training naturally prefer stenographic or clerical work, but as the war progresses, more and more of this class offer to take up physical work. This is the class of women the company is trying especially to interest. The working conditions that

will meet this class will also attract another class of women, those between the ages of twenty-two and thirty with only a grammar-school education who have been obliged to work for years at some physical task.

ADJUSTING THE WOMEN TO THE WORK

While the work has to be adjusted to the women's physical strength the women have to be adjusted to the work to a greater degree by teaching them the details of the business, avoidance of accidents, and the proper treatment of the men with whom they work and come in contact. Mr. Stevens pointed out that in England and elsewhere various costumes have been adopted for women engaged in industrial work which approach in utility and appearance the overalls and jumpers of the men. These costumes generally in his judgment are ones which the more intelligent class of women would not care to wear, and those sold in the stores at present are in most cases not made of material suitable in color and quality or else are cut in an exaggerated way. Very often they combine all these defects, together with scarcity of sizes and continuous changing of styles. Then, in the case of women working with men, climbing over ladders, walking over piles of stock, leaning over and working on material on the floor, it is desirable to have the costumes made in such a way that the women look as inconspicuous as possible, and the costume which has been worked out has been developed around this essential requirement. The following description gives some of the details and the reasons for them:

Blouse and Bloomers.—In order to reduce the cost it has been necessary to eliminate all unnecessary buttons and details, and the middy blouse meets all these requirements best. The sleeve is made full with a button at the wrist so that in the summer it can be rolled up to the elbow and in the winter buttoned down. The blouse is made so that it can be worn over a sweater in the winter when stock rooms are drafty. This arrangement is superior to the common one of having the blouse fit tightly around the waist, which would require a sweater to be worn outside with the likelihood of its being readily soiled or injured, and in other ways detract from the idea of uniformity.

In reaching for material above the head, pushing trucks about and lifting boxes it is desirable to have the waist as free as possible, and for this reason the bloomers have been arranged to be supported from the shoulders by suspenders. To allow the garment to be removed readily a backward fold is made over each hip, held by a button supplied by the makers and attached by the wearer to fit. The bloomers are made very full with a band around the top and are drawn in at the bottom by another band and buckle midway between the ankle and the calf of the leg.

The cloth has been chosen for wearing qualities and color so as not to show dirt readily and to be durable and fast. It is dark-blue drilling, and is shrunk before being cut.

The suit is made to measure by one of the department stores and delivered in twenty-four hours. Six costumes have been made on these lines, varying slightly in detail, and all have proved entirely satisfactory to the women.

Shoes, Cap, Stockings, Insignia, Etc.—There is some difficulty in finding suitable shoes for women at this time, and most of those in stock are either of bad shape or else are not rugged enough for stock-room requirements. There are two types which have been on the market for some time neither of which is wholly satisfactory—the "Prescription" shoe, sold at $6.50, and the "Nurse's Panacea" shoe, at $3.50. The former is a high-grade orthopedic shoe, but fails in that it is not rugged enough, and the latter, while easy on the feet, is not very strong and soon loses its shape. After talking with the company doctor on the matter the official who drew up the recommendation became convinced that the proper line of procedure is to find some type of orthopedic shoe at about the price of the "Prescription" shoe.

The cap is similar to that worn by nurses except that it has been reduced to the lowest terms and costs practically nothing. The cap is required because of the dust and also in order to prevent the hair getting in a disordered condition.

Stockings should be black and should be strong.

One of the standard costumes sold in the stores which since has gone temporarily out of stock had on the sleeve the letters "N. S. S. A.," or "National Service Suit of America." This caused considerable interest, and one woman who did not have the letters on her sleeve worked them on with a needle. This brought to mind the possible advantage of having on the left sleeve some insignia which would appeal very much as do the naval insignia on the sleeves of the sailors. As the work has resulted from conditions due to the war it seemed well to carry out this idea by placing the words "War Supply Service" on the sleeves.

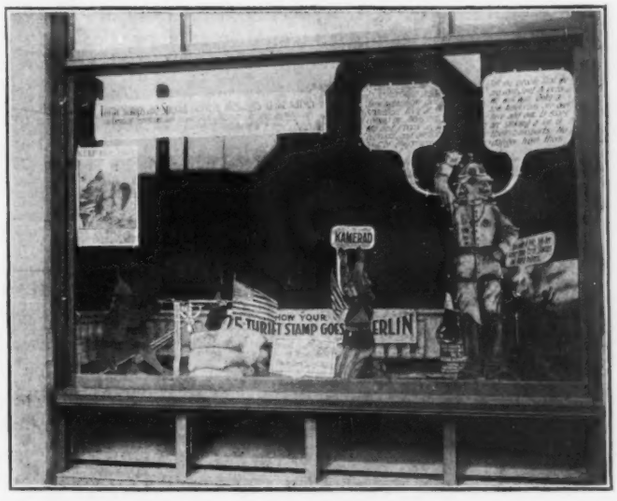
The company expects to raise the standard of the class of women who are going into the work materially and already finds an increasing number of promising applicants. While it does not care to say much about the future after the men return from the war, the work of the women is being watched with much interest to see if the rearrangement of the stock-room work will not disclose the fact that quite a large proportion of it is well within the ability of women.

Big Bond Totals Cheer the Boys

THRIFT STAMPS FEATURED BY HARTFORD COMPANY

A Window Display Made by Connecticut Central Station in the Interest of War Funds Wins Approbation of Patriotic Community

The Hartford (Conn.) Electric Light Company recently "ran" a window display on behalf of thrift-stamp purchases which attracted widespread attention. Among



STRAFING THE KAISER IN A NEW ENGLAND CENTRAL-STATION SHOW WINDOW

the numerous "war windows" of this company, this made one of the biggest hits of the year and evoked many expressions of approval from patriotic citizens anxious to see the government's war chest kept full.

The World Power Is Liberty's

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Automobile Headlamps and Glare-Reducing Devices.—L. C. PORTER.—In spite of all the study that has been given to the subject of automobile headlighting and the legislation that has been enacted to eliminate glaring lights from highways, there has not yet been developed a thoroughly satisfactory device or method to overcome this troublesome feature. However, much can be done to mitigate the evil through proper adjustment of lamps and the correct use of diffusing devices.—*General Electric Review*, September, 1918.

Generation, Transmission and Distribution

Hydroelectric Developments in Tasmania.—RICHARD H. MOORHEAD.—The hydroelectric system developed at the outlet of Tasmania's inland sea, situated 80 miles from the city of Hobart, is described. The energy is used principally in the supply of Hobart and for electrochemical and metallurgical industries, especially the production of electrolytic zinc and calcium carbide.—*Journal of Electricity*, Sept. 1, 1918.

Standard Outdoor Substation.—J. T. BRONSON.—The development of satisfactory switching and transformer equipment for outdoor installation along high-tension transmission lines has been a big factor in extending the service of electric power companies. Through the use of this apparatus the need of special buildings for shelter has been dispensed with, and service can be furnished at a profit in many cases where previously the interest on the investment for buildings, equipment, etc., and the cost of attendance would have shown a loss. In this article are outlined the requirements of outdoor switching apparatus and the types and equipment of outdoor substations. Curves are given to show the comparative cost per kilovolt-ampere of outdoor substations of various size.—*General Electric Review*, September, 1918.

Influence of Poor Power Factor Upon Output.—A. LÉAUTÉ.—By an unfortunate coincidence, at the moment when the war necessitated the maximum production of electrical energy in France, there was an unforeseen falling off in power factor which caused a marked diminution of output. This has led to many studies of the problem, some of which have been already noticed in the Digest. The one now referred to has for its object not to recount the well-known causes of the phenomenon but to analyze the resulting conditions. The author endeavors to determine with exactitude the law according to which the power transmitted by the feeders and the power produced by the alternators both decrease under out-of-phase conditions. He arrives at formulas which express in a striking manner the loss of power that is so caused and which, he contends, deserve the attention of the public authorities with a view to the rectification of prevailing conditions.—*Revue Générale de l'Electricité*, Aug. 10, 1918.

Methods for More Efficiently Utilizing Our Fuel Resources, XXI.—MARIUS R. CAMPBELL.—A map showing and classifying the coal fields of the United States and a diagram giving the chemical composition and calorific values of different grades of coal form part of this article. A table showing the original and present quantity of coal in the United States, the production of the mines in 1913 and 1914 and the total production from the beginning of coal mining to the present time is given. The estimated production of coal in the United States to the year 2055 is interesting.—*General Electric Review*, September, 1918.

Improving Engine Economy, II.—M. A. SALLER.—A discussion of the possible increase of efficiency and capacity of engines by giving proper attention to the steam supply.—*Power Plant Engineering*, Sept. 1, 1918.

Traction

The Swiss Electric Railways.—A. GIVELET.—In a comprehensive review of the mountain railways of Switzerland, in which comparisons of cost per ton-kilometer are made between electric and steam lines operated in three ways—by adhesion simply, as rack roads and by a combination of both systems—the author concludes that the advantage of electrical operation increases with every increase of grade. For instance, it has been shown that with a grade of 7 per cent and a speed of 18 km. an hour 160 hp. will operate an electric train carrying eighty passengers as compared with 213 hp. with steam traction. Moreover, with electricity, grades as steep as 10 per cent can be negotiated without the necessity of installing a rack road. To the well-known advantages of electric operation the author adds two which, he says, have not been sufficiently insisted on—the avoidance of hauling trains of coal for the engines, which has proved a hindrance to traffic, especially on single-track roads, and the possibility of operating electrically snow plows at night, thereby doing away with the heavy expense to which steam lines are put in removing snow.—*Revue Générale de l'Electricité*, Aug. 24, 1918.

Installations, Systems and Appliances

High-Speed Circuit Breakers for Chicago, Milwaukee & St. Paul Electrification.—C. H. HILL.—Each of the fourteen substations in the 440-mile electric zone of the Chicago, Milwaukee & St. Paul Railway is now equipped with a high-speed circuit breaker, some of which have been in operation for over a year. This protective device is connected into the negative return circuit between the ground and the negative bus, and it is in parallel with a limiting resistance which becomes effective immediately the breaker opens. The article describes the details of construction of this unusual equipment, to which brief reference was made in the July issue.—*General Electric Review*, September, 1918.

Electric Winding Engines and Mine Hoists.—H. H. BROUGHTON.—In this article the mechanics of the winder are considered. Simple expressions are given which lead to the evaluation of the cardinal points of the torque diagram of a balanced cylindrical-drum winder. Finally the derivation of the diagram by a step-by-step method is explained.—London *Electrician*, Aug. 16, 1918.

Electrically Driven Printing Presses.—In this article particulars regarding a series of electric motors installed for driving printing presses at the works of Morrison & Gibbs, Edinburgh, Scotland, are set forth. Starting and control devices are discussed. These starters are called "inching" starters because the motors may be "inched" forward as much as the work in hand may require by the method of alternately closing and opening the motor circuit in quick succession so that the motor armature is permitted to revolve only a short distance at a time and is not allowed to accelerate to its normal speed. It is worthy of note that prior to the installation of the electric equipment the works were driven by a modern and efficient steam-engine plant which was in excellent running order. The firm, however, was persuaded that the conversion to electric driving was absolutely necessary if it was to keep its large printing business abreast of the times. It therefore scrapped the engine plant though the boilers are still retained for heating purposes.—London *Engineer*, Aug. 16, 1918.

Induction Motor Troubles, II.—GORDON FOX.—Consideration is given in this article to the troubles occurring within induction motors. These are classified and discussed under two heads, mechanical and electrical.—*Power*, Sept. 10, 1918.

Mining Electrical Engineering.—C. JONES.—A continuation of this paper, presented before the South Wales Institute of Engineers, discussing the necessity of installing reactance on systems in order to limit the mechanical stress imposed on circuits by current flowing through a fault between phases This is best secured by inserting the reactance at a point where all such fault currents must pass, such as at the generator terminals.—London *Electrical Review*, Aug. 16, 1918.

Bibliography of Electric Welding.—WILLIAM F. JACOB.—Reference is made to some 250 articles on the subject of electric welding.—*General Electric Review*, September, 1918.

Electrophysics and Magnetism

Capacity-Potential Curves of an Induction Coil.—E. TAYLOR JONES.—An expression is given for the maximum secondary potential of an induction coil calculated on the theory that two oscillations are set up in each circuit at break. The relation between the primary capacity and the secondary potential and that between the maximum efficiency of conversion and the coupling are shown by means of calculated and experimental curves. The present results are compared with those found in previous experiments on the relation between capacity and spark length. The uses of capacity-potential curves in the determination of the constants of induction coils are discussed, and examples are given of the calculation of optimum capacities. A repetition of Rayleigh's rifle-bullet experiment is described, the result further confirming the present theory.—London *Electrician*, Aug. 30, 1918.

Some Properties of Metals Under the Influence of Alpha Rays.—A. G. MCGOUGAN.—The delta-ray current from a metal under bombardment by alpha-rays in high vacuum is reduced by scraping the surface of the metal with a steel scraper while the vacuum is maintained. The reduction effected in these experiments varied from 6 per cent for platinum to 37 per cent for lead, but it is not permanent. These experiments indicate that the delta-ray effect is due to a gas film on the surface. The reduction of delta-ray activity by heating and by continued low pressure shows that the surface film under these circumstances loses gas molecules to its surroundings which are not replaced from the residual gas.—*Physical Review*, August, 1918.

Specific Inductive Capacity of Metals.—FERNANDO SANFORD.—In a table given in this article it is seen that the metals take their places in the contact or frictional series with dielectric substances just as the latter do with each other. The natural inference is that the places are determined by the dielectric constants of the substances. If this is true, the specific inductive capacities of metals are of the same order of magnitude as are those of non-metallic substances, and the more electro-positive a metal is in the contact series, the higher is its specific inductive capacity.—*Physical Review*, August, 1918.

Electrochemistry and Batteries

Discharge Characteristics of a Certain Make of Dry Cell.—C. A. GILLINGHAM.—A careful study of the discharge characteristics of a 6-cm. by 15-cm. dry cell made by a well-known firm. The tests were made by discharging to give end-point voltages, (1) through constant resistances, (2) at constant current through varying resistances, (3) through "mazda" lamps. In each case the cells were discharged either continuously, or half, quarter, an eighth, etc., of the time. The results are given and discussed in extenso.—*Paper presented at convention American Electrochemical Society*, Sept. 30, 1918.

Nitrogen Fixation Furnace.—E. KILBURN SCOTT.—The various types of electric arc furnaces for fixing nitrogen are first reviewed and compared. The Kilburn-Scott three-phase furnace is then described in detail (comparing it with other furnaces), taking up such points as the balance of the current phases, starting the furnace, size of furnace, radiation and cooling-water losses, electrodes, stabilizing the arc, power factor, reactance, air supply, air compressor, preheated air, effect of increasing oxygen in the gas, effect of increasing pressure, absorption of the products, cooling the gases, raising steam in boilers, and theory of the reaction and its reversibility.—*Paper presented at convention American Electrochemical Society*, Sept. 30, 1918.

Units, Measurements and Instruments

Current Transformer Ratio and Phase Error by Test Ring Method.—H. S. BAKER.—This method of testing may be indicated briefly as follows: A special current transformer or test ring is connected with its primary and secondary of the current transformer under test. The number of turns in the secondary coil of the special current transformer is varied until the primary and secondary ampere turns of the special current transformer or test ring are equal to each other and show a balance. Then the ratio of turns in the special

current transformer is the current ratio of the transformer under test. Of course, the primary and secondary ampere turns can never actually balance, because they are not exactly in step or opposition, but a point can be found where the vector difference between them is at right angles to one of them, and this point is taken as the balance point. This actual minimum value of vector difference gives a measure of the phase difference between primary and reversed secondary amperes. —*Proceedings A. I. E. E.*, September, 1918.

Miscellaneous

Effect Upon Fuel Economy of Different Arrangements of Baffles.—LIEUT. WILLIAM G. EAGER.—Different arrangements of baffles for the most economical production of steam from coal are discussed, together with tests made at the combination ice and electric plant of the Valdosta (Ga.) Lighting Company. The principles considered in the investigation, arrangement of baffles, discussion of results, conclusions as to completeness of tests and recommendations as to further research are given. There are few improvements that can be made at comparatively small expense which offer such encouraging possibilities of improvement in economy as the proper arrangement of baffles.—*Journal A. S. M. E.*, September, 1918.

Education and Training of Engineering Apprentices. —P. H. S. KEMPTON.—In this article of the series the author describes work being done in Germany for the training of engineering apprentices and points out that ten years ago there were in Germany 10,000 well-educated men over eighteen studying engineering, compared with only 900 in Great Britain. In Germany continuation schools, compulsory for workmen and apprentices under eighteen, are in use throughout the country. Larger firms maintain their own schools. Here a part of each day is given up to the instruction of the apprentices, though some night schools and early morning hours are made use of. No cultural work is attempted in this connection. The writer recommends for consideration in England that education of apprentices should proceed side by side with their trade training and during work hours. This educational training should not be entirely vocational, but general culture, citizenship and physical training should find a place in the curriculum. A periodic sifting process is necessary in order to render the training most efficient and economical. Specialized training and adequate prospects must be offered to prospective teachers in such schools.—London *Electrical Review*, Aug. 9, 1918.

Electrically Welded Ships.—This deals with the welding of a ship 125 ft. between perpendiculars and 16 ft. beam, with a displacement of 275 tons. The hull was rectangular in section amidships, with only the bilge plates curved. It was made of seventy-one transverse frames and contained three bulkheads, those fitted fore and aft being watertight and the one amidships non-watertight. The shell plating was $\frac{1}{4}$ in. and $\frac{5}{16}$ in. (6.3 mm. and 7.8 mm.). All joints were lapped in the manner described. Some interesting details are provided of the comparative cost of the electric-welded and riveted barge.—London *Electrician*, Aug. 9, 1918.

Electric Arc Welding.—A. M. CANDY.—The exacting demands of the present world war have given a tremendous impetus to the application of electric-arc welding methods for making rapid repairs to a great variety of machinery and apparatus required in the successful conduct of the conflict. The British Admiralty has adopted the process extensively for ship construction, including minor structural parts and calking of seams, and for partially eliminating riveted construction. At present the United States Shipping Board has an active welding committee working upon the application of electric welding with a view to ultimately producing merchant ships which will be largely built by welding instead of the present riveted construction. Probably the chief reasons for the apparent apathy of the general industrial world toward arc welding are the haphazard methods employed, using any kind of electrical equipment, any kind of wire for electrode material and any kind of laborer or general handy man as a welder. This situation is being gradually improved, as indicated by a number of articles appearing recently in the technical press, which emphasize the proper methods for the execution of satisfactory welds, general methods of supervising and inspecting welding work, and the selection of proper electrical equipment.—*Proceedings A. I. E. E.*, September, 1918.

Value of Peat Fuel for the Generation of Steam.—An abstract from a report made by John Blizard to the Canadian Department of Mines (*Bulletin No. 17*, Dominion Government Printing Bureau of Ottawa) is presented. After an introduction on the general uses of peat, methods of conducting tests are given in full.—London *Engineer*, Aug. 9, 1918.

New Type of Reinforced-Concrete Poles.—A new type of pole for power transmission lines has recently been developed and tested by a firm in Geneva, Switzerland. The poles are built up of hollow blocks which are light enough to be easily transported. After being placed one on top of the other, reinforcing rods are placed inside, after which cement is poured in, making the whole one solid structure. Experiments were made with two types of pole. Poles for telegraph lines were approximately 20 ft. (6 m.) high, extending 5 ft. (1.5 m.) underground. Dimensions were 10 in. by 10 in. (25 cm. by 25 cm.) at the base, while the top half measured 8 in by 8 in. (20 cm. by 20 cm.). The blocks are reinforced with $4\frac{1}{2}$-in. (11-cm.) round rods, placed $1\frac{3}{4}$ in. (44 mm.) from the outside. These rods are not provided with barbs. Rupture resulted after a load of 233 lb (106 kg.) was applied for ten minutes. The deviation at 18 ft. 9 in. (570 cm.) was $5\frac{3}{4}$ in. (15 cm.). Microscopic cracks appeared after thirty minutes with a load of 121 lb. (55 kg.) (deviation 3 in. = 8 cm.). The large poles measuring 28 in. by 32 in. (70 cm. by 80 cm.) at the base were made up of four columns 11 in. by 12 in. (28 cm. by 30 cm.). The outside dimensions at 15 ft. 6 in. (475 cm.) were 22 in. by $26\frac{3}{4}$ in. (56 cm. by 68 cm.), and the columns $9\frac{1}{2}$ in. by $9\frac{1}{2}$ in. (24 cm. by 24 cm.) The first microscopic cracks appeared when a load of 335 lb. (152 kg.) was applied vertically and 353 lb. (160 kg.) horizontally. Measurements of the deviation with this load were no longer exact as the foundation supporting the poles started to give. The tests proved that the poles so constructed could withstand a load reaching from 200 per cent to 300 per cent of the normal. They seem as strong as if made out of one solid piece of concrete, the joints between the blocks having no influence whatever on the resistance of the poles.—*Schweizerische Bauzeitung.*

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

FUSE CUT-OUTS, REACTIVE LINK.

In connection with the development of a heavy-service oil-immersed cut-out, we have designed a new form of fusible element to be used where the conditions are exceptionally severe, and more particularly with voltages above 2500. In this "reactive link" the main fusible strip is shunted by means of two inductively wound, inclosed helixes of high resistance, and the final rupture of the circuit occurs within these inclosures. When the main link melts only a small, quickly suppressed arc results, because the current is shunted through the inclosed helixes. This current is quickly reduced owing to the rapid increase in resistance before the melting point is reached. The coils of the secondary link are surrounded by porous material thoroughly saturated with oil, and this structure causes the final interruption of the current to take place simultaneously at a number of points within the inclosures. In this way very quiet operation is secured under the most severe conditions and the period of arcing as well as its intensity is materially reduced. Oscillograph records under the same short-circuit conditions show that with a plain link the arc continued for 0.155 second, while with an inductive shunt its duration has been reduced to 0.017 second.—*L. W. Downes, Providence, R. I.*

LIGHTNING ARRESTER, ELECTROTHERMAL.

The item referring to the electrothermal lightning arrester on page 1280 of the ELECTRICAL WORLD for June 15 is not quite correct. The discharge does not force the water, which acts as an electrolyte, through the needle valve, but forces it out of the electrolytic chamber, through a pipe at the bottom, into a reservoir at a somewhat higher level. This breaks the contact between the electrodes and leaves the electrolytic chamber filled with hot air and steam. The needle valve, which gives an outlet at the top of the electrolytic chamber, relieves the pressure by permitting both hot air and steam to escape slowly. This permits the electrolyte to return from the reservoir to the electrolytic chamber and re-establishes the contact so that the lightning arrester is again ready to operate.—*H. M. St. John, Research Engineer, Commonwealth Edison Company.*

RECTIFIER FOR HIGH VOLTAGES.

High-tension rectification by means of two electrodes of different materials placed in an atmosphere of carbon dioxide and sulphur dioxide is a promising field for research. In the writer's experiments on the reduction of high-tension alternating currents, gas under pressure was sent through one of the electrodes, striking the face of the second electrode. Hydrogen, sulphur dioxide, carbon dioxide, air and ammonia gas were used at different pressures, and a marked degree of rectification was found to take place at a certain critical pressure. Some of these gases gave better results than the others. Carbon and a pool of mercury as electrodes show fine tendencies for rectification, especially when ammonia gas is used. The writer has used these high-tension rectified currents in charging electrostatic condensers for generating high-frequency currents for radio-telegraphy and radio-telephony.—*Samuel D. Cohen, Brooklyn, N. Y.*

Apparatus Available

TORONTO (CANADA) LABORATORY OF HYDROELECTRIC POWER COMMISSION OF ONTARIO.

(1) 300,000-volt, 60-cycle, 300-kva. transformer; (2) 75,000-volt, 25-cycle, 50-kva. transformer; (3) 33,000-volt, 25-cycle, 1-kva. transformer; (4) three-element oscillograph, with photographic equipment; knockdown table and packing cases to facilitate shipping and setting up in the field; (5) 3-in. (7.6-cm.), 6-in. (15.2-cm.) and 10-in. (25.4-cm.) sphere-gap voltmeters; (6) oscillation transformer; (7) 1-kva. motor-generator set to supply constant alternating-current voltage for meter calibration (it consists of a direct-current motor and an alternator; the set is operated from a battery); (8) 10-ft. (3-m.) photometer, distribution photometer, 10-in. (25.4-cm.) integrating sphere, 84-in. (2.1-m.) integrating sphere, lift racks for multiple and series lamps; (9) approximately 20,000 sq.ft. (1858 sq.m.) of floor space will be shortly available for laboratory purposes.—*W. P. Dobson.*

Suggestions for Research

CABLES, AERIAL, FOR POWER TRANSMISSION.

Aerial cables have been used in special cases in several installations throughout the country for pressures as high as 26,000 volts where open-wire construction was undesirable and the cost of underground construction prohibitive. Experiments and data are desired on the current-carrying capacity of such cables, the effect of direct sunlight and of the color of paint upon the temperature rise, the relative merits of rubber, varnished-cambric and paper insulation, difficulties in joints due to different expansion of the messenger cable, etc.

CABLES, DIELECTRIC LOSSES IN.

The matter of dielectric loss in cables should receive most careful attention, both from cable manufacturers and users. Manufacturers must not be hampered by impracticable and lightly considered specifications. On the other hand, conservatism of manufacturers must not block the road to progress, and as soon as the laws governing dielectric loss can be determined and a practical method of measuring these losses developed the most efficient cable will be called for and must be produced.—*A. I. E. E. Committee on Transmission and Distribution.*

HUNTING OF SYNCHRONOUS MACHINES.

Develop a simple instrument which will accurately determine the amplitude, frequency and form of hunting. Then (a) find if amplitude and frequency are related in any way, (b) make an accurate determination between these factors and the field current. Is the form of surging always a sine wave? If a frequency meter were available which would read to one one-hundredth of a cycle per second, the problem would be made easier.—*R. Brown, Cornell University, Ithaca, N. Y.*

INSULATORS.

Continuation of the investigation of the insulator problem. While at present porcelain seems to be the most available material, yet it is not beyond possibility that some other material such as fused quartz (Mr. Peaslee's work) or even glass may be used.—*A. I. E. E. Committee on Transmission and Distribution.*

MAGNETS, PERMANENT, STANDARD TEST.

The committee on magnetic properties of the American Society for Testing Materials in its 1918 annual report recommends certain definitions of normal residual induction and of normal coercive force, and also proposes a standard magnetic test for material intended for permanent magnets. Those interested should perform these tests and investigate their accuracy, universal applicability and desirability for practical purposes. This should be done before the society adopts these tests as standard.—*Editorial Suggestion.*

NITROGEN FIXATION.

The most interesting electrochemical development of the year is the construction of the cyanamide nitrogen-fixation plant at Muscle Shoals, Ala. Two unique features in this plant are the use of steam for the generation of the electric energy and the use of 60-cycle current for the calcium-carbide furnaces. These features will give interesting subjects for study—on the one hand the energy item in the cost of making ammonium nitrate by the cyanamide process and on the other the power factor of carbide furnaces with high-frequency current.—*A. I. E. E. Committee on Transmission and Distribution.*

POLYPHASE SYSTEMS, UNBALANCED.

In a paper by C. L. Fortescue (A. I. E. E. *Proceedings*, 1918, p. 629), a general method is given for resolving an unsymmetrical and unbalanced systems of polyphase currents, voltages or impedances into a number of symmetrical components. A number of practical problems are solved in the paper, but much remains to be done in order to simplify the formulas and the notation used for unbalanced three-phase circuits.

PROTECTIVE DEVICES.

In view of the proposed interconnection of transmission and distribution systems throughout the country, as a measure of economy and fuel saving, it is recommended that this subject be investigated thoroughly, particularly to determine what protective features are necessary in tie lines for the purpose of insuring continuity of service and stability of operation. Among other subjects which might be investigated are the following: (1) Relays on generators, transformers, synchronous converters, etc. (2) Lightning arresters for transmission lines. (3) Preparation of definite recommendations regarding the standardization of relay nomenclature and rating of circuit breakers. (4) Detrimental effect of power reactors.—*A. I. E. E. Protective Devices Committee.*

SYNCHRONOUS MACHINES, ARMATURE REACTANCE AND REACTION.

In view of the great and constantly growing importance of the subject and of the large amount of literature with contradictory assertions and methods, it is highly desirable for a theoretical expert to go over the whole problem, analyzing critically the various fundamental assumptions made and checking the results against a large number of accurate tests on machines with widely different constants. As a result of such a critical investigation, certain facts should be established beyond any contest or doubt, others to be valid within certain limits, and still others to be rather indefinite and in need of empirical coefficients or further tests. This is a big problem and could be profitably undertaken only if the principal manufacturing companies promised to furnish test data and agreed to perform special tests prescribed by the expert in charge of the work.—*Editorial Suggestion.*

X-RAYS, SINGLE-IMPULSE EXPOSURES.

In some cases of medical examinations, especially with children and restless patients, it is highly desirable to have an instantaneous exposure of the photographic plate, which means a single electrical impulse of sufficient suddenness and intensity. Some work has been done in this direction, but much remains to be done to increase the intensity, so as to keep the X-ray tube further from the patient. A single-impulse generator has been previously developed for testing dielectrics at transient voltages, and a similar idea may be applicable in this case. In view of the importance of roentgenography in military medicine this problem deserves most serious attention. [See a paper by Dr. R. Knox, presented at the April, 1918, meeting of the Institution of Electrical Engineers (British).]—*Editorial Suggestion.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DAYLIGHT-SAVING MEASURE ENCOUNTERS OPPOSITION

Bill Which Has Passed the Senate Awaits Action by House of Representatives, Where Fight Is Anticipated

Senator Calder's daylight-saving bill, which seeks to make the present scheme of daylight saving applicable throughout the year and which was unanimously passed by the United States Senate last week, is still awaiting action in the House of Representatives.

Considerable opposition to the measure has been aroused throughout the country particularly by the original proponents of the daylight-saving measure. It has been pointed out that none of the European countries where the daylight-saving scheme has been in force for some years has ever extended it beyond the summer period, so that if for no other reason than uniformity the United States should not depart from the original daylight-saving measure.

The Attorney General of the State of New York opposes the bill for the reason that it will seriously interfere with the opening and closing of polls on election day, that it would lead to litigation concerning expiring insurance policies and that the New York State law provides for daylight saving up to the last Sunday in October. Inasmuch as this law cannot be remedied until the New York State Legislature meets again in January, a change by the United States government will create a conflict between legal New York State and federal time.

Another objection has been raised by Dr. Abram Jacobi, the eminent physician, who gives warning that in winter to get everybody out of bed before daylight or soon afterward would have a deleterious effect on public health.

Lend to Me, Please—Uncle Sam

ADDITIONAL ENDOWMENT FOR ENGINEERING RESEARCH

Ambrose Swasey Adds Another Hundred Thousand in Appreciation of the War Service Engineering Science Has Rendered

At a joint meeting of the trustees of the United Engineering Society with the Engineering Foundation Board in New York on Oct. 7 announcement was made that Ambrose Swasey of Cleveland, Ohio, had given the Engineering Foundation an additional $100,000 for endowment of engineering research.

Mr. Swasey, who is a past-president of the American Society of Mechanical Engineers, is well known as a designer and builder of large telescopes and other optical instruments and fine machine tools. In 1915 he gave $200,000 for engineering research, so that the total endowment is now $300,000. Mr. Swasey's original gift made possible the establishment of the Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. His gifts have been inspired by his conviction as to the necessity for research in engineering science not only in connection with the war but for keeping the United States in the forefront of nations in industrial development. This latest gift is an expression of Mr. Swasey's appreciation of the war service which the United Engineering Society and the Engineering Foundation have rendered to the country.

Let Your Children Have Peace

INSTRUMENT FOR TESTING ELECTRIC WELDS NEEDED

Fleet Corporation Finds Lack of Means for Determining Value of Electrically Welded Joint Inimical to Shipbuilding Success

There is a great and urgent need for a simple workaday instrument or means for properly determining the relative strength or value of an electrically welded joint, according to J. G. Dudley, who is a member of the electric welding committee of the Emergency Fleet Corporation and of its research sub-committee, which is now affiliated with the National Research Council. He says:

"To those who have gone deeply enough into the question of electric welding such a testing machine would not seem to be vitally necessary, but in the shipbuilding industry all work of any sort must be so done as to pass the approval of the so-called classification societies. Chief among these is the British Lloyds, whose ultra-conservatism is blocking somewhat a wider use of electric welding. The principal reason probably is that its inspectors, in widely separated localities, naturally cannot be all-around technicians, and, lacking some simple means of satisfying themselves that an electrical weld is strong, they take the stand that it is wrong and disapprove it or condemn it. Some of the most eminent specialists and the best laboratories in the country have been attacking this problem for many months, but they have not yet solved it."

It is suggested that those who have ideas on the subject communicate directly with Mr. Dudley, in care of Chester Shipbuilding Company, Finance Building, Philadelphia, Pa.

STEEL OUTLOOK BRIGHTER BUT IS NOT REASSURING

Survey Just Completed by the War Industries Board Shows Present Steel Production Far Behind Actual War Demands

Some improvement in the steel situation was shown by a survey just completed for Steel Administrator Replogle of the War Industries Board, but officials in Washington stated on Wednesday that production is still far behind war demands and the outlook for supplies for non-war industries for the remainder of the war is not bright.

Pig iron is now being produced in the United States at the rate of more than 42,000,000 tons a year and steel plates at the rate of nearly 6,000,000 tons, both records in the industry. The plate production is more than 40,000 tons a week greater than ever before.

Production of all steel is running at the rate of only approximately 33,000,000 tons a year, however, and the demands of the government and the Allies are at the rate of about 50,000,000 tons.

A vast amount of steel is required in the manufacture of electrical apparatus and supplies, in electric transmission towers and in the fabrication of central-station structures, substations and steam and coal-handling equipment.

Beat the Germans Back—Buy Bonds

FURTHER CURTAILMENT IN ELECTRIC HEATING APPLIANCES

War Industries Board Restricts Output for Next Six Months to 50 per Cent of Six Months' Production During 1917

The Priorities Division of the War Industries Board in carrying out the plan of the board to conserve material, labor, fuel, transportation and capital in general industry for the purpose of supplying the supreme war demands announced Oct. 10 additional curtailments in electric heating appliances, including electric stoves and ranges. Effective Oct. 1 and for six months thereafter, the output of these devices has been curtailed 50 per cent of the six months' production during 1917.

Buy Bonds—It's War Service Work

APPEAL FOR TELEGRAPHERS FOR SERVICE IN FRANCE

Bonus Workers Needed by the Signal Corps—Physical Standard Will Be Lowered for Men with Technical Qualifications

The Signal Corps announced on Wednesday of this week that it needs 750 bonus telegraphers for service in France. Men skilled in telegraphy between the ages of eighteen and fifty-five inclusive should apply at once for details to the chief signal officer of the army at Washington. One hundred and fifty qualified men are to be sent abroad immediately and the rest will go overseas at the rate of about eighty a month.

The men who enter the service will be kept in training camps for instruction only long enough to receive the necessary clothing and equipment. The Signal Corps states specifically that the physical standard will be lowered in cases of men having the necessary technical qualifications, so that practically any one who is physically able to do his work will be accepted.

If You Like Liberty, Lend for It

GATHERING OF ELECTRICAL MEN IN LOS ANGELES, CAL.

Second "Get-Together" Dinner of California Electrical Co-operative Campaign Draws an Attendance of More than Four Hundred

Under the auspices of the California electrical coöperative campaign, the second "get-together" dinner for 1918 was held in Los Angeles on Oct. 4. More than 400 members of the electrical fraternity in southern California were present, a feature of the gathering being the presence of over fifty women all actively engaged in some branch of the industry. R. H. Ballard, vice-president of the Southern California Edison Company, was toastmaster, and the speakers and subjects were as follows: "Solving New Problems," L. H. Newbert, chairman advisory committee; "War-Time Finances," A. N. Kemp, comptroller Southern California Edison Company; "What to Do," A. E. Wishon, general manager San Joaquin Light & Power Corporation; "War and Women," Miss Gertrude Tucker, Edison company, Los Angeles; "Priorities," D. E. Harris, Pacific States Electric Company; "Let There Be Light," Col. H. D. Loveland, member Railroad Commission, State of California; "More Synergism," R. M. Alvord, General Electric Company; "Mars and the Electric Shop," M. L. Scobey, San Francisco; "To-day's Opportunities," G. E. Arbogast, president California Electrical Contractors and Dealers' Association; "Help Wanted," S. M. Kennedy, secretary and general agent Southern California Edison Company.

The meeting was also addressed by Major Wishard, a prominent "four-minute man," and A. H. Halloran, secretary of the Pacific Coast Section, N. E. L. A., told of the advantages of membership in the National Electric Light Association and what is being done for members.

The keynote of the meeting was the practical discussion of "questions of the hour," in which all were keenly interested. Experienced speakers told dealers and contractors how they could continue to operate profitably, even in war times, by readjusting their businesses so that they could take advantage of changing conditions. Central-station men explained some of the limitations under which they now are operating and demonstrated that the power companies are doing their share in assisting war industries and that they could do more if more capital were made available to develop further their hydroelectric properties. The subject of priority rules laid down by the War Industries Board was carefully gone into, and explanation was given as to the classes of goods affected and the reasons therefor. Dealers were much interested in the information given about the new orders concerning the future manufacture of carbon and metallized-filament lamps and the probable change of attitude on the part of local central stations regarding free lamp renewals.

During the evening opportunities were not overlooked

by the speakers to stimulate interest in the fourth Liberty loan, and it was evident that all present had already made liberal purchases and some were going back for more. Patriotic music and songs were part of the program from start to finish, and the evening was conspicuous for the enthusiasm of the gathering and the snappy manner in which the up-to-date subjects were handled. The dinner throughout emphasized the general belief that the California electrical coöperative campaign is an undoubted success and that the manner in which the work is being handled by the advisory committee and the field men has the approval of those interested in the electrical industry throughout the state.

Drive the Bayonet Home—Buy Bonds

WAR UTILITY PROBLEMS DISCUSSED IN KANSAS

Increasing Operating Expenses, Higher Rates, Lightless Nights, Public Education and New Business Are Topics of Interest

The conduct of utility business under war conditions was the topic of a one-day informal discussion by thirty delegates to the annual convention of the Kansas Public Service Association at Hutchinson, Kan., Oct. 4. The date of the meeting had been changed from Oct. 16, 17 and 18 to Oct. 4 because of the demands which government activities are making of central-station men. At the meeting it was decided to go even further in this time conservation program by discontinuing regular meetings of the association throughout the coming year. No definite plans were made, therefore, for the coming year's convention, and no outline for association work was laid down. The representatives expressed themselves as feeling rather that all should hold themeslves in readiness to heed a call at any time the officers of the association believed national or state-wide good could be done by holding a meeting.

Since the association will remain in this semi-dormant state, it was thought best to continue the present officers in power indefinitely as they have a grasp of the situation which will enable them to deal promptly with any emergency. It was the expressed understanding, however, that as soon as the war is over the association will again become active in the matter of regular meetings.

The program included provisions for discussions of fuel costs, other operating expenses, lightless night requirements, rates and temporary increases, education of the public and new business. There was also considerable discussion on classification of accounts following a report presented by a committee of the Kansas Public Utility Commission on this subject. Classification is patterned after the National Electric Light Association's classification. It is expected that the classification will be submitted to the Kansas Public Utility Commission not later than Nov. 1. When it is approved it will be available for all properties of any size in Kansas and will enable them to keep their accounts so that they can make tax reports and furnish information to the government and state authorities easily at any time.

Considerable stress was laid on the importance of the National Electric Light Association's accounting course of instruction, and a committee was appointed to solicit National Electric Light Association members among the smaller companies and urge upon them that they take advantage of this accounting course. The point was brought out at the meeting that on Oct. 1 one of the utility's commissioners said that it was the opinion of the commission that utilities in general should be permitted to increase their rates, but the commission was not inclined to disturb the present rate structures, preferring to add as a war measure certain percentages of increase to the present rates and planning to discontinue these increases six months after peace is declared. It seems that a large number of Kansas utilities will ask for increases on this basis.

On fuel costs it was the consensus of opinion that energy production costs in Kansas are from 48 per cent to 61 per cent higher than in pre-war days. Taxes have increased an average of 30 per cent, wages an average of 60 per cent. There was considerable discussion as to the effects of government employment agents taking labor necessary to operation of utilities. A committee was appointed to investigate this and see if utilities are being fairly treated in the matter considering that they are classed as essential.

The discussion of appliance sales indicated that every company to date has sold more appliances than before the war. It was the opinion that this condition is caused by the unusual prosperity in Kansas and by the facts that there is an increasing shortage of gas and that coal is costing very much more. It was also pointed out that probably a great many people who previously had insufficient income to enable them to purchase electric appliances are now well able to afford them.

In the discussion of lightless nights the delegates agreed that the amount of fuel saved by this order amounts to about one-tenth of 1 per cent of the fuel burned to make electricity. It was also brought out that in nearly all cases the rebate made to municipalities for lightless night outages should be and is made on the basis of the cost of fuel saved. This plan is in effect among the properties of the Kansas Gas & Electric Company.

L. O. Ripley, vice-president of the Kansas Gas & Electric Company, gave a very interesting talk on the subject of public policy. He stated that at this time there is an unusual opportunity to educate the public by presenting locally the conditions under which each utility operates. He said this is the time to combat socialistic tendencies by bulletins, talks and advertisements on the history of the company's growth and on operating subjects presented from the layman's point of view.

There was some disappointment among the delegates over the fact that the state fuel administrator and the engineer for the oil division of the Fuel Administration for the mid-continent field had been called to Washington and were therefore unable to attend the convention.

The officers who will continue in power for the ensuing year are: President, J. D. Nicholson, Newton, Kan.; secretary-treasurer, W. W. Austin, Cottonwood Falls; executive committee, A. M. Patten of Topeka, L. O. Ripley of Wichita, C. L. Brown of Abilene, H. W. Magruder of Liberal, L. S. Small of Concordia, and Walter S. Grundy of Hutchinson.

JOBBERS' AND POWER CLUB MEETINGS ARE POSTPONED

Prevalence of the Epidemic of Influenza Throughout the Country Has Led Ohio Medical Authorities to Issue Edict Against Conventions

The war service convention of the Electrical Supply Jobbers' Association, which was scheduled to be held at the Hotel Statler, Cleveland, Oct. 21, 22 and 23; the fall meeting of the Electric Power Club, which was to be held in the same city at the same hotel on Oct. 17, and the war service convention of the manufacturers of electrical apparatus, including members of the Electric Power Club and all other electrical apparatus manufacturers, have been indefinitely postponed. Owing to the epidemic of influenza the medical authorities of the State of Ohio have ordered postponement of conventions for three weeks, and in view of the edict of the health authorities and of the inability of the various associations to make other arrangements indefinite postponement was decided on.

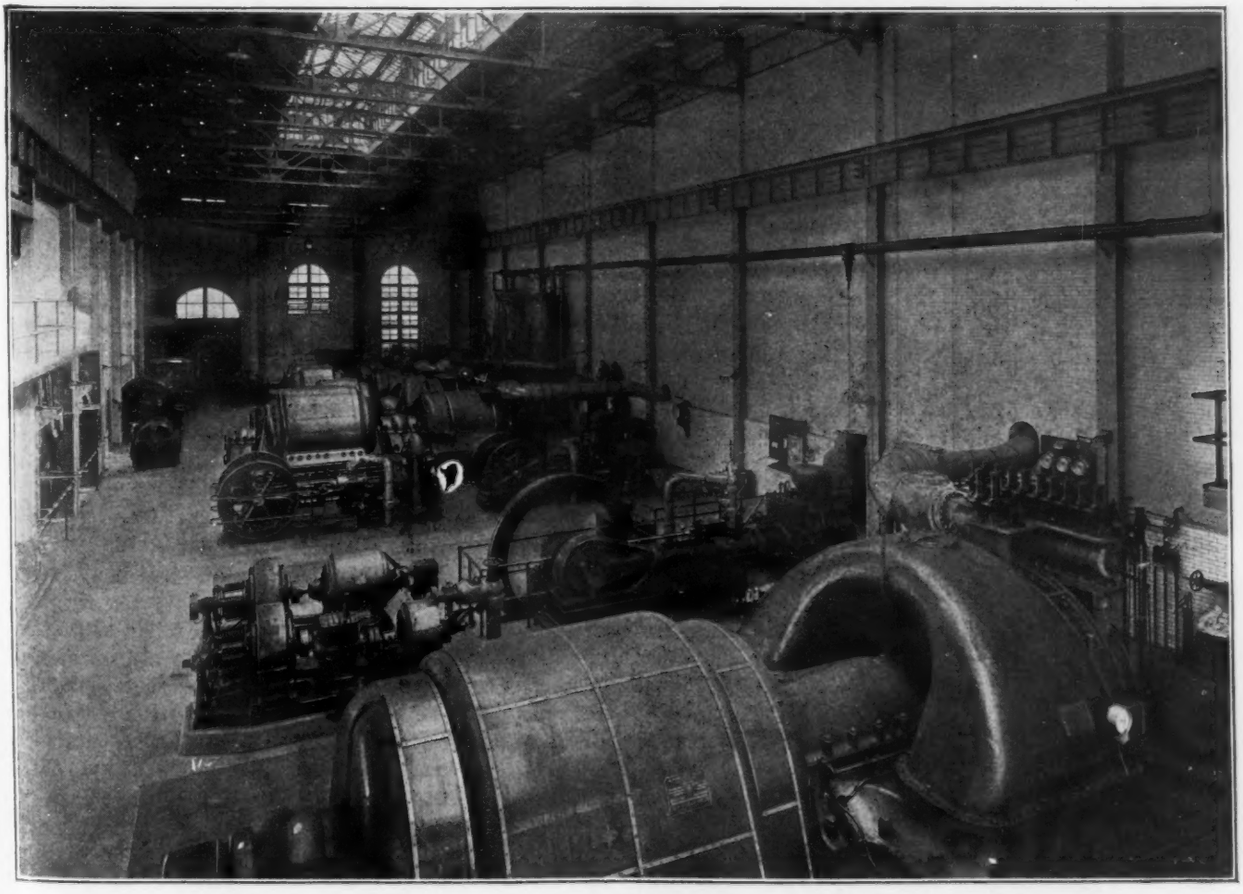
The meetings of the jobbers and the manufacturers were to be among the most important held by those organizations, the subjects to be taken up for consideration being restricted entirely to war service. It was the intention of the Power Club, for instance, to take up such subjects as priorities in obtaining materials for direct and indirect government orders, procedure necessary to obtain materials for making up stock, rulings as to what classes of business and orders may be called essential and how classified, explanation of the reports that must be made to the War Industries Board, conservation of materials used in electrical apparatus, conservation of capital, conservation of labor, etc.

The Electrical Supply Jobbers' Association had purposely moved its meeting forward for the purpose of discussing as quickly as possible government regulations of the supply industry.

Confederate Gunboat Comes to Light in Louisville Plant Construction

Intake-tunnel and condenser-well construction were interesting and difficult engineering features of the recent additions to the generating station of the Louisville (Ky.) Gas & Electric Company. In sinking these water passages to a depth of 40 ft. below the Ohio River bed the caisson method was employed. The heavy caissons cut through the hull of an old Confederate gunboat sunk during the Civil War. Some of the wood brought up by divers was in such good condition that the engineers had it turned into "policemen's clubs" to preserve as souvenirs.

Work is completed on the one 15,000-kw. turbine unit which was being added to bring the station rating up to 47,500 kw. Another 15,000-kw. unit is on order for this plant and will be installed, it is expected, early in 1919. It is from this plant that the Louisville company supplies the large government camps and many war industries.



NEW STATION OF THE LOUISVILLE GAS & ELECTRIC COMPANY, ADDITIONS TO WHICH ARE BEING MADE

RELATION OF WATER-POWER CONSERVATION TO FUEL SAVING

The Economies of Stored Water Power and the Possibilities of Saving Through Redevelopment of Existing Water Powers

Before the Special Commission on Water Resources created by the Massachusetts Legislature to investigate conservation and development of water power, Charles T. Main, consulting engineer, Boston, recently presented an outline of the principal economic factors bearing upon storage. A résumé of Mr. Main's remarks is given below.

The principal items bearing upon the development of storage reservoirs are: (1) The cost of development, including land damage, physical structures, legal, engineering and incidental expense; (2) the amount of water that can be stored and used, taking into account evaporation, distance from reservoir to point of utilization, size of millponds, number of hours in the day when used, and head under which the water is or can be used. The benefit effected by stored water in producing power is principally in the saving of fuel which would otherwise be required to produce the same amount of power in an auxiliary plant. One million cubic feet of stored water, if all were used under 1-ft. head, would produce about 18 kw. on the power-plant switchboard.

The amount of coal required to produce a kilowatt-hour in the average industrial power plant of about 1000 kw. rating is about 2.5 lb. (1 kg.). The cost of this amount of fuel ranges from 0.375 cent with coal at $3 per short ton to $1.25 with coal at $10. This is on the assumption that no use can be made of low-pressure steam available from the steam-power production which the stored water displaces. If low-pressure steam can be used, the amount of coal per kilowatt-hour chargeable to power is somewhat less. A fair average for the cost of coal is about $0.0075 per kilowatt-hour. The saving on account of fuel due to 18 kw.-hr., or 1,000,000 cu.ft. of storage water per foot of head, assuming complete utilization, is 13.5 cents. Control and maintenance of reservoirs would probably average 1.5 cents per 1,000,000 cu.ft. (28,000 cu.m.) of head, leaving a net saving of about 12 cents per 1,000,000 cu.ft. of head. Capitalized at 10 per cent, this would warrant an expenditure of about $1.20 per 1,000,000 cu.ft. of stored water per foot of head, with complete utilization. This 10 per cent would cover interest, depreciation, taxes and extraordinary repairs.

STORED-WATER POSSIBILITIES

On a river where there are a number of powers, each with a considerable head and a pond of good size, all owned by the same interests, it is possible to use stored water almost completely in some years. In other years it may be difficult to make use of much storage, either because of an exceptionally wet year or because the reservoir did not fill in the spring. If the storage reservoir is comparatively large, there is sometimes a possibility of reducing the size of the auxiliary steam plant or other sources of supplementary power if the reservoir is so controlled that it will increase the minimum flow.

On rivers where there is a diversity of interests, some running twenty-four hours a day and others for shorter periods, or where the heads are low or the ponds small, or any combination of these conditions, it is always impossible to make full use of the stored water. One of the chief difficulties is to let the water out of the reservoirs in such a way that it will arrive at each plant at a usable time. In most cases of this kind probably not more than 50 per cent of the storage would be used. The investment warranted in such a case would then be not over about $0.60 per 1,000,000 cu.ft. per foot of head, or $60 for each 100 ft. of head. The auxiliary plant should never be smaller on account of storage in cases of this kind. On small rivers the water power is apt to be an auxiliary to a steam plant, and the storage is then strictly a fuel-saving affair. This is also true where the power other than that obtained from water power is purchased and where the power bill is somewhat reduced owing to storage.

STORAGE RESERVOIRS IN NEW ENGLAND

The two principal storage reservoirs built in New England in the last few years are the Aziscohos, on the Magalloway River in Maine, and the Somerset, in Vermont. The former has a capacity of 8,000,000,000 cu.ft. (224,000,000 cu.m.) at a cost of $125 per 1,000,000 cu.ft., and the latter, owned by the New England Power Company, has a capacity of 2,675,000,000 cu.ft. at a cost of $299 per 1,000,000 cu.ft. On the Millers River preliminary investigation of the prospective development of storage for use at Turners Falls and Holyoke, Mass., by existing hydroelectric and mill power organizations shows that about 12,500,000 kw.-hr. a year could be realized in addition to existing power, assuming only 20 per cent wastage. The saving is estimated at $110,000 yearly. The estimated cost of the proposed reservoirs is over $2,276,000, and it appears that the state or private owners would have to carry an annual burden of at least $120,000 for the privilege of saving about 14,000 tons of coal yearly in this proposition. If the owners of the water powers benefited by these storage reservoirs (on the Millers River) are to pay the total cost, Mr. Main pointed out, they will be at a disadvantage from a competitive standpoint with the water-power owners on other rivers of the state. As all the developed falls on the Millers River are comparatively low, about 13 ft. average, their first cost must be comparatively high already, and any additional expense as contributions to storage reservoirs would increase them still more.

REDEVELOPMENT OF EXISTING WATER POWERS

The total rated wheel capacity on the Millers River is about 7450 hp. under a total fall of 318 ft. (97 m.). Of this, 4526 hp. is used for twenty-four-hour power and 2924 hp. for ten-hour power. The average efficiency of the wheels, most of which were installed some time ago, is probably about 65 per cent, with a maximum of 75 per cent. The actual output of these wheels is probably not over 6500 hp. The advance in the art of hydraulic turbine design and installation in the past decade has been very marked, and efficiencies of 85 to 90 per cent are now attainable. This increase of 20 per cent in power can be obtained with no more water through the more efficient use of the head formerly employed. Some of the present developments would justify larger installations. Through redevelopment of the pre-

ent water powers on the Millers River about 21,500,000 kw.-hr. additional power could be obtained at an approximate estimated cost of $1,742,000. At 0.75 cent per kilowatt-hour this would represent a return on the investment of 9 per cent. In case only the more advantageous powers were redeveloped, the additional amount of power would amount to 18,588,860 kw.-hr., and the estimated cost would be $1,132,000, which, at 0.75 cent per kilowatt-hour, represents about 12 per cent on the investment. In any case the wheel installations will have to be redeveloped sooner or later, even if the reservoirs are built, and the fixed charges will not represent additional yearly cost as in the case of the reservoirs.

Storage possibilities on the Westfield River are less promising than on the Millers River because of the greater cost due to the topography of the river valley and the inability to use the stored water on the Connecticut River.

Storage on the large rivers which pass through Massachusetts and are interstate streams holds out a much better promise for a reasonable return on the investment than do intrastate Massachusetts rivers. On the Connecticut River from Windsor Locks north there are nine principal points of utilization with an aggregate head of 289 ft. (88 m.). All of these powers have ponds of considerable area, most of them with comparatively high heads so that the ponds may be drawn down several feet. As the distance between them is considerable, it is possible that stored water on the Connecticut River would be used with not more than 25 per cent waste. On this basis for the use of stored water and its value as before, an investment of 90 cents per 1,000,000 cu.ft. per foot of fall would be warranted, or about $260 per 1,000,000 cu.ft. of storage. On the Merrimac River probably 250 ft. (76 m.) of fall would benefit by storage on the headwaters, and not over 35 per cent of wastage should be necessary, thus warranting an expenditure of about 80 cents per 1,000,000 cu.ft. per foot of fall, or about $200 per 1,000,000 cu.ft. storage.

Nearly all the fall of the Deerfield River, both developed and undeveloped, is controlled by the New England Power Company, which has already developed some storage. The developed fall amounts to about 500 ft. (150 m.) with approximately the same amount of undeveloped fall. In this case practically no wastage would be necessary and an expenditure of about $1,200 per 1,000,000 cu.ft. would eventually be warranted for storage on this river.

Storage reservoirs are of the least value on relatively small rivers having low falls, small millponds and a diversity of ownership. They are of greater value on the large rivers which use the water under comparatively high heads, with large millponds capable of controlling the daily fluctuation in the use of water. They are of maximum value on rivers using the water under higher heads than usual, where the millponds are large enough to regulate the daily use of water and where the interests are all under one control. From a conservation standpoint, storage developments might be warranted where they would not be justified for power alone, in which case a part of the expense should be borne by the state or federal government and not all put upon the power owners. Many existing water-power plants could be redeveloped along modern lines at reasonable cost for increased efficiency. An additional opportunity for conservation exists through interconnection of power systems so that the wastage of ten-hour power may be used in twenty-four-hour plants. In many plants considerable expenditure would be required to electrify the existing mechanical equipment.

End the German Evil—Buy Bonds

CALIFORNIA COMPANY IS TO USE NATURAL GAS FOR FUEL

San Joaquin Light & Power Corporation Builds 26-Mile Line to Supply Bakersfield Steam Plant Which Has Used Fuel Oil

During the latter part of August, 1918, the San Joaquin Light & Power Corporation, Fresno, Cal., completed a 26-mile (42-km.) natural-gas line to supply fuel to its Bakersfield steam plant. The completion of this line inaugurates a very practical war saving measure in that natural gas will be used under the boilers of the steam plant instead of fuel oil as in the past.

The natural gas is purchased from the Midway Gas Company and comes from the Midway (Cal.) oil fields. The gas company was organized in the beginning to supply natural gas to the city of Los Angeles and operates a 12-in. (30-cm.) pipe line from the Midway field to Los Angeles for that purpose. Natural gas is collected from the wells in the Midway field and compressed in a compressor plant up to a pressure of from 250 lb. to 300 lb. per square inch (17.5 kg. to 21 kg. per sq.cm.) at which it enters the pipe line for Los Angeles.

The San Joaquin pipe line consists of pipe 6 in. (15.2 cm.) in diameter, the joints of which are butt-welded by the oxyacetylene process. No flanges or screw joints are used on the entire line. The connection to the Midway Gas Company's 12-in. line is made at a point 26 miles from Bakersfield, and the 6-in. main is carried from that point to the steam plant.

It is expected that approximately 6,800,000 cu.ft. (190,500 cu.m.) of gas per twenty-four hours can be delivered at the 250 lb. to 300 lb, pressure through the 6-in. main to Bakersfield. Using an equivalent figure of 6000 cu.ft. (208 cu.m.) of gas to one barrel of fuel oil, this shows a saving of over 1100 barrels of oil per twenty-four hours when the pipe line is working at its full capacity.

The battery of boilers at the Bakersfield plant consists of four 325-b.-hp. and eight 603-b.-hp. units. The four smaller ones were originally provided with gas burners, but the eight larger units so far have been equipped only for the burning of fuel oil. Gas for burning under the four gas-fired boilers was purchased from the Valley Gas Company, which supplies natural gas from the Midway field for use in the city of Bakersfield. The quantity available for these boilers, however, has been a very variable quantity in the past, and the company decided to install a line of its own in order to make the fuel supply more dependable and also to extend gas firing to all boilers at the plant.

A pressure governor at the plant steps down the pressure from the pipe line to about 50 lb. to the square inch (3.5 kg. per sq.cm.), but this pressure is again reduced at the burners to from 0.75 lb. to 2 lb. (0.05 kg.

to 0.14 kg.) to the square inch. The oil burners have been removed, but no change in the furnace is required for burning gas, so it is always possible to change back to oil firing in case of failure of the gas supply. This change can be made on one-half hour's notice.

The entire pipe line was laid in approximately seventy days. Welding was begun by experienced welders, but before the job was finished the work was being done by Mexican day laborers. No serious trouble was encountered, except that a piece of defective pipe blew up when tested out with full pipe-line pressure, but this was not due to any fault of the welding.

Not only does the burning of gas at this plant furnish a good war saving measure, in that it allows a considerable quantity of oil to be used for war purposes, etc., but it also shows a substantial financial saving to the company. Two years ago fuel oil was purchased for use at the Bakersfield steam plant at 50 cents per barrel. The price now has risen to almost $2 per barrel.

Does It Thrill You?—Buy Bonds

BOSTON EDISON OPERATIONS UNDER THE WAR CONDITIONS

Cost of Coal Averaged 53 per Cent More per Ton, but by Skillful Operations Kilowatt-Hour Cost Increased Only 20 per Cent

Operating results on the Boston Edison system for the year ended June 30, 1918, afford an interesting example of the effect of war conditions upon the business and handling of a large urban central station.

Compared with 1917, the cost of coal averaged 53 per cent more per ton, yet through skillful operation the manufacturing cost per kilowatt-hour increased only a fraction over 20 per cent. The actual average coal costs per ton were $5.75 and $3.76, and the system manufacturing cost per kilowatt-hour, including labor, fuel, water and supplies, was 8.73 mills in 1918 and 7.27 mills in 1917. A better measure of plant efficiency is the coal consumption per kilowatt-hour generated, which was 1.95 lb. for 1918 and 2.005 lb. the year before. On this system the substations are operated by the generating department, and the net production cost at the company's principal plant is actually lower than is indicated above from the figures drawn from the company's return as a whole. During the past year the company consumed 232,225 long tons of coal, compared with 223,438 the year before. The total kilowatt-hours generated in 1918 were 267,646,180, against 249,235,384 in 1917.

At the beginning of the summer the company had on hand about two months' supply of coal in 1917, but on account of the shortage of last winter it started the summer of 1918 with but four weeks' supply in hand. Vigorous efforts have been made this past summer to accumulate coal to meet the forthcoming winter load, and with some co-operation from customers at the time of the peak in the winter months it is expected that the loads can be carried satisfactorily. In common with other central stations in New England, the company is not actively seeking new business, but is making every possible effort to handle the war service which it is constantly being called upon to supply. Some of the most important army and navy plants in eastern Massachusetts are now operated on central-station service.

In 1918 the total income from sales of electrical energy was $9,623,605, or 4.75 cents per kilowatt-hour sold. The company's service was rendered at a lower average price to the community than in 1917, notwithstanding the fact that its total expenses increased from $5,457,924 to $5,769,449 in the period. The average income per kilowatt-hour was 5.03 cents in 1917. Even in power sales the customers received a lower average unit price, namely, 2.69 cents in 1918 against 2.98 cents last year. The principal increase in energy sales came in the power business. In 1917 the company sold 63,595,719 kw.-hr. for power only, and this year it sold 83,385,453 kw.-hr. for power service exclusively. The street railway consumption fell off about 700,000 kw.-hr., and the revenue from street lighting dropped off somewhat. The company succeeded in cutting down its distribution expenses by about $39,500 this year and reduced its office and management costs by about $102,000.

Good management is reflected in the increase of the system load factor from 35.8 per cent in 1917 to 37.2 per cent this year and in the improvement of the ratio of the connected load to the yearly peak. Last year the connected load was 3.46 times the peak; this year it was four times the peak. Doubtless the development of the industrial war load is a vital factor in this result, but there has clearly been a creditable selection of business from the standpoint of available facilities.

In recent years the growth of business has led to a continual increase in the number of employees, but this year the company lists 80 fewer persons on its payroll, the 1918 total of employees being 2106. The average load throughout the entire year was 31,200 kw. in 1918 and 28,840 kw. in 1917, and the number of customers increased during the past year from 97,323 to 105,011. The income per customer was $96 in 1917 and $91.50 this year. The company declared the usual 12 per cent dividends.

COMPARATIVE DATA BOSTON EDISON COMPANY

	1918	1917
Average income per kw.-hr. sold, cents	4.75	5.03
Average income per kw.-hr. power sales, cents	2.69	2.98
Cost of manufacture per kw.-hr. generated, cents	0.873	0.727
Pounds coal per kw.-hr. generated	1.95	2.005
Average cost of coal per ton	$5.75	$3.76
Average cost of coal per kw.-hr.	$0.005	$0.0034
Income per kw. connected load	$28.70	$33.20
Ratio, connected load to yearly peak	4 to 1	3.46 to 1
Income per customer	$91.50	$96.00
Total income from sale of electricity	$9,623,605	$9,235,778
Income from commercial lighting	6,191,153	6,143,310
Income from street lighting	874,134	885,296
Income from power sales	2,241,472	1,897,286
Income from street railway power	200,072	202,147
Income from energy sold other companies	116,771	107,737
Total expenses	5,769,449	5,457,924
Expenses of manufacture	2,336,146	1,814,533
Expenses of purchased energy	34,692	22,263
Expenses of distribution	1,103,167	1,142,663
Expenses of offices and management	1,094,471	1,196,032
Taxes	938,178	1,022,564
Miscellaneous	262,793	259,866
Dividends declared, total per cent	12	12
Dividends declared, amount	$2,703,360	$2,703,066
Kw.-hr. generated	267,646,180	249,235,384
Kw.-hr. generated and purchased	273,102,645	252,732,114
Kw.-hr. sold by company	202,481,467	183,642,995
Kw.-hr. sold for power only	83,385,453	63,595,719
Kw.-hr. sold for street railways	10,699,780	11,437,494
Maximum load in fiscal year, kw.	83,966	80,539
Coal used in year, tons	232,225	223,438
Coal cost per ton, average	5.75	3.76
Number of employees	2106	2186
Total connected lighting load, kw.	149,258	141,246
Total connected load in kw.	335,198	278,051
Total number customers	105,011	97,323
Coal on hand June 30, tons	22,241	40,885
Average load in kw.	31,200	28,840
Yearly load factor in per cent	37.2	35.8

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical League of Cleveland.—The regular Thursday meeting of the Electrical League of Cleveland was held Oct. 10 at the Statler Hotel. Congressman H. I. Emerson spoke on the topic "War-Time Washington."

San Francisco Electrical Development League.—At the luncheon of this league on Sept. 25 an address was given on "The Mons Retreat" by Sergeant Fred Greene of the Canadian Expeditionary Forces, recounting his personal experiences.

Institute of Radio Engineers.—On Oct. 9 the Institute of Radio Engineers held a meeting at the Engineering Societies Building, New York City, at which a paper was presented by Dr. Edwin F. Northrup, Princeton University, on "Special Heating Effects of Radio Frequency Current."

Technical Publicity Association.—The October meeting of the Technical Publicity Association held Oct. 10 in New York City was addressed by George F. Lord, director of advertising, Du Pont de Nemours Company, on "Advertising in War Times." Roy F. Soule, editor of *Hardware Age*, spoke on "Force to the Utmost."

N. E. L. A., Philadelphia Section.—On Tuesday, Oct. 1, the Philadelphia Section of the National Electric Light Association held its first meeting of the year. It has been decided that the first Tuesday of each month will be given over to the main or general section meeting. The second Tuesday will be given to the meter department, the third to the engineering department, and the fourth to the commercial department branch of the section.

A. S. M. E.-Indianapolis Section, A. I. E. E.—The council of the American Society of Mechanical Engineers meets in Indianapolis on Oct. 25 and 26, and in connection with this meeting an elaborate gathering of the Indianapolis, Cincinnati, St. Louis, Chicago, Milwaukee, Detroit and Cleveland sections has been arranged. The Indiana Engineering Society, the Indianapolis-Lafayette Section of the A. I. E. E. and the Indianapolis Section of the American Society of Automotive Engineers have also been invited. The headquarters of the meeting will be the Claypool Hotel, where also the two professional sessions scheduled and the committee meetings will be held. Members intending to go to Indianapolis should get in touch with their local committee and secure reservations. The program includes symposiums on fuel conservation and research.

Jovian League of Kansas City.—At its annual meeting held Oct. 1 the Jovian Electric League of Kansas City elected the following officers: President, W. M. Hand, manager General Electric Company; secretary-treasurer, J. D. Todd, manager Missouri Valley Electric Company.

National Safety Congress.—"Ways and Means of Reducing Industrial Accidents and Conserving Man Power in the Strenuous Times of War" were discussed during the week of Sept. 16 at St. Louis, where several hundred safety engineers, works managers and insurance men met in convention at the National Safety Congress. Among the speakers was Charles M. Schwab of the Emergency Fleet Corporation, Dr. Thomas Darlington of the American Iron and Steel Institute and Frank E. Norris of the American Rolling Company.

International Association of Municipal Electricians.—An address by A. M. Schoen, engineer of the Southeastern Underwriters' Association, was a feature of the convention of the International Association of Municipal Electricians held Sept. 25 at Atlanta, Ga. The subject of Mr. Schoen's address was "The Application of Science and Engineering to the War." Other papers at the meeting were on "Municipal Safety Rulings," by A. MacLachlan of Detroit, and "The History and Development of the Fire-Alarm Telegraph," by J. B. Yeakle, superintendent of fire alarm at Baltimore, Md. The convention was also addressed by Morton G. Lloyd of the National Bureau of Standards, A. L. Pierce of Wallingford, Conn., R. A. Smith of Norfolk, Va., and Major K. B. Ferguson of the British Royal Artillery.

A. I. and S. E., Philadelphia Section.—The program for 1918-19 of the Philadelphia Section, Association of Iron and Steel Electrical Engineers, has been announced as follows: Oct. 5, "Electric Furnaces," by George H. Schaeffer, Carpenter Steel Company, Reading, Pa., and I. B. Lindemuth, Bethlehem Steel Company. Nov. 2, "The Employment of Female Labor in the Electrical Departments of Large Industrial Works"; a general discussion in which prominent engineers have been invited to take part. Dec. 7, "Plate-Mill Drive," by G. E. Stoltz, Westinghouse Electric & Manufacturing Company. Jan. 4, 1919, "Machine-Tool Drives," by H. W. Tice, Bethlehem Steel Company. Feb. 1, "Electrical Features of Hog Island," by John H. Anderton and H. W. Osgood, American International Shipbuilding Corporation of the United States Emergency Fleet. March 1, a joint meeting with the American Institute of Electrical Engineers; lecture by Dr. W. S. Franklin, Massachusetts Institute of Technology. April 5, "Power Transmission," by H. B. Vincent, of Day & Zimmerman, Inc., Philadelphia. May 3, general discussion. June 7, annual outing. The meetings will be held in the Engineers' Club.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

California Rate Increase.—The California Railroad Commission has authorized the East Counties Gas & Electric Company, Santa Cruz, to increase electric rates on account of higher costs. The advance is 1.5 cents per kilowatt-hour for energy sold for lighting purposes, 0.5 cent per kilowatt-hour for energy sold for power purposes, an increase of 10 per cent for energy sold for street lighting and an increase of 20 per cent for energy sold for railway purposes. The increased charge will be shown separately on the bills. The surcharges apply on all regular meter readings taken on and after Sept. 20. The increase is due to increased cost of material of all kinds and wages. During the last few months the company has also had to generate a great deal of power by oil on account of the shortage of hydroelectric power in central California due to the very dry winter. As indicative of its increase in cost of material, the company now pays in Santa Cruz County $2 per barrel for oil, whereas one year ago the company was able to purchase this commodity for 79 cents a barrel.

Higher Costs Held to Be Offset in Part.—Regarding increased operating costs, the Illinois Public Utilities Commission says in part, in approving higher rates for the Central Illinois Light Company, Peoria: "It appears that the increased cost at present prevailing for fuel alone over that which prevailed in 1916 is at least 0.25 cent per kilowatt-hour, and it further appears that the increase of total production expense has equaled approximately the increased fuel cost. While expenses other than fuel which are involved in production expense have doubtless increased over those which would have prevailed under similar conditions in 1916, it is probably true that these other increases have been absorbed by the increased output which the company has realized due to the increased loads of the manufacturing interests in Peoria. These increased loads have been very material in character, with the result that the company because of them has largely increased its output and thus has been able to assimilate the increased expenses other than fuel to an extent such that, upon a kilowatt-hour basis, these other expenses have not shown a material increase. These facts have also, of course, operated to a similar extent in the distribution expense and general expense incurred by the Central Illinois Light Company."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rate Increase in California.—The Railroad Commission of California has authorized an increase in electric light and power rates by the Western States Gas & Electric Company, Eureka division.

Lightless Nights Continued in California.—Lightless nights, which were originally intended to be in effect for August and September only, will be continued indefinitely, according to a recent announcement made by Albert E. Schwabacher, California Fuel Administrator. Electric displays on Saturday and Sunday nights, however, will be permitted as heretofore.

Electrical Tricycles Wanted for Wounded Soldiers.—Consul H. D. Van Sant, writing from Dunfermline, Scotland, says that efficient hill-climbing electric tricycles or motors for use by wounded soldiers would meet an urgent need and that if such a machine were ready at the close of the war the sales reached would be beyond any figures yet reported. It is suggested that the price should be below $500.

Rate Increase in Worcester, Mass.—The Worcester (Mass.) Electric Light Company has notified consumers that, owing to increased cost of coal, labor and material entering into the manufacture and distribution of electricity, it has become necessary to make an increase in the power price, effective on all bills rendered on and after Dec. 1, 1918. This is to take the form of a surcharge of 5 mills per kilowatt-hour, which will be added to the regular monthly bill. This surcharge will be discontinued when pre-war conditions prevail.

Revised Central Station List.—The McGraw Central Station List for 1918 has just made its appearance. The present volume contains 800 pages and lists 5776 companies in the United States, Canada, Mexico, West Indies, etc. More than 15,000 changes have been made in the new edition, which, besides giving the officers and equipment of central stations, has statistics on the total number of private and municipal plants, companies selling supplies, companies having day service and towns with a population under 1000 getting electric service elsewhere, information on the state commissions and an index to stations whose names do not indicate their location.

War Service Directory of Electrical Manufacturers.—An official directory of electrical manufacturers, covering both apparatus and supplies, has been issued by the General War Service Committee of the Electrical Manufacturing Industry in co-operation with all of the group committees engaged in war service. It includes, so far as these committees have been able to gather the information, the name and address of every manufacturer in the United States of products so far identified with the war service organization of the electrical industry. The directory was prepared to enable departments, bureaus and other divisions of the federal government to locate readily all manufacturers of any required electrical apparatus or supplies.

Manufacturing Power Plant for War Needs.—The War Department authorizes the following statement: The Construction Division has been authorized to erect a 4000-kw. power plant with all the necessary equipment for the Milton Manufacturing Company at Milton, Pa. This company is manufacturing supplies for the army, and its present power equipment is inadequate to meet the urgent demands. The estimated cost of the buildings and equipment is $350,000. The Milton Manufacturing Company will eventually take over this power plant, paying for it by deducting a certain price per shell in future contracts. In the event that this method of payment does not meet the cost, provision is made to repay the balance within two years after the cessation of hostilities.

Consolidation of Niagara Companies.—Under the plan of consolidation of the Niagara Falls Power Company, Hydraulic Power Company and Cliff Electrical Distributing Company, the Niagara Falls Power Company is to be formed in New York with $26,000,000 authorized stock. The $5,757,700 outstanding stock of the present Niagara Falls Power Company is to be exchanged for $11,515,400 preferred and $984,566 common in the new company, the $500,000 Cliff Electrical Distributing Company stock for $540,000 new common stock, and the $12,000,000 Hydraulic Power Company stock for $12,960,000 new common stock. In compliance with the New York law, the stock "does not exceed the aggregate of the outstanding capital stocks and the surpluses and undivided profits of said corporations."

Great Fuel Saving in Connecticut.—The administrative engineer of the Bureau of Conservation, United States Fuel Administration, in Connecticut reports that those industrial plants which have furnished answers to the fuel-saving questionnaire are in a majority of cases making the changes suggested in the power-plant recommendations. Eighty plants, consuming for the year ended May 1, 1918, practically 337,000 tons of coal, as a result of the conservation changes suggested will save at least 15 per cent, or more than 50,000 tons of coal, annually. This state had previously reported from similar sources an annual coal saving of approximately 31,000 tons. The administrative engineers in Michigan, Kansas, Georgia, North and South Carolina and Florida have reported marked savings of coal in industrial plants as a result of the practical demonstrations of conservation.

Power Restrictions Removed in California.—Restrictions in the use of power by gold dredgers, cement plants and sand, gravel and crushed-rock plants were entirely removed by the Power Administrator of California, H. G. Butler, on Sept. 30. Mr. Butler explains that the order will stand for at least thirty days from that date. It was possible to remove the restrictions because the rains of two weeks ago and heavy mountain rains in the last three days, together with the large decrease in rice and other irrigation, has relieved the reservoir situation considerably. Mr. Butler said that if there were no additional rains within the next thirty days it was probable the restrictions of the past, which have extended since the middle of July, would have to be reimposed. The gold dredgers are pronounced essential industries by the federal government. The cement plants and sand, gravel and crushed-rock plants were not declared essentials, but the restrictions imposed by the government on construction are such as to reduce these industries to a minimum so that their use of power will not be great.

Organized Purchasing in France After the War.—Discussing the importance of collective selling in industrial reconstruction in France, Pierce C. Williams, United States commercial attaché at Paris, writes that the American manufacturer should prepare for a revolutionary change in French methods of purchasing when the war ends. Instead of selling to thousands of individual buyers the materials each will need to rebuild his destroyed or damaged factory, the American manufacturer will deal with a small number of central purchasing agencies, representing groups of French manufacturers engaged in the same or related industries and assisted by the credit of the French government. Unless, therefore, the American manufacturer prepares for coöperative selling he may be under a serious handicap as far as furnishing industrial assistance to France after the war is concerned. Scattered American selling efforts will not be able to meet the requirements of the huge purchasing power of several thousand French consumers exercised through state-aided buying organizations. Estimating the cost of construction before the war of a few of the industries of northern France that are known to have suffered most, Mr. Williams mentions: Central electric stations and distribution, 300,000 kw., 250,000,000 francs: machinery and electrical manufacturing plants, 500,000,000 francs. In 1915 the Central Association for the Restoration of Industrial Life in the Invaded Regions was organized. One of the four groups in this covers mining, metallurgy, heavy machinery and electrical construction.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Frank B. Steele, power engineer of the Dayton Power & Light Company, resigned on Oct. 1 to become associated with the Charles M. Kelso Company, industrial engineer and contractor, Dayton, Ohio. Mr. Steele was graduated from the Virginia Military Institute in the electrical department in 1905 and later from the George Washington University of Washington, D. C., with the degree of E. E. After completing the two-year engineering apprenticeship course with the Westinghouse Electric & Manufacturing Company he was promoted to be construction engineer, making installations of power plants and substations, particularly on property of the United States government. Later he was a coal operator in West Virginia for three years prior to coming to Dayton, and during the last five and one-half years he was connected with the Dayton Power & Light Company as power engineer. He was a member of the new-business committee of the Ohio Electric Light Association in 1916 and 1917 and chairman of the power and heating section in 1918.

F. B. STEELE

Henry R. Stevens, formerly of the firm of Stevens & Rockwell, consulting engineers, Seattle, Wash., has become electrical engineer for the Stone & Webster Engineering Corporation, Seattle Division.

Robert A. Bachman, for many years connected with the Edison Storage Battery Company, West Orange, N. J., as vice-president and general manager, is now engaging in an executive capacity for the Wright-Martin Aircraft Company, with headquarters at Long Island City, N. Y.

Dr. A. E. Kennelly of Harvard University and the Massachusetts Institute of Technology has recently returned from a trip overseas during the summer on special duty for the United States Army Signal Corps. Dr. Kennelly was appointed civilian liaison officer in the Signal Corps early in June, and after having completed his military duties has returned to Cambridge, Mass.

J. C. McClendon, formerly new-business manager of the Lorain County Electric Company at Elyria, Ohio, has been transferred by the Doherty Organization to a similar position at Lorain, succeeding W. E. Quillin.

W. D. Hart, formerly district superintendent of the Illinois Northern Utilities Company at Belvidere, Ill., has been appointed general contract agent for the Illinois Northern Utilities Company at Dixon, Ill., to succeed D. C. Yontz, resigned.

George H. Smart, whose resignation as commercial manager of the Knoxville (Tenn.) Railway & Light Company was noted in the ELECTRICAL WORLD of May 4, 1918, is now manager of the Nebraska Gas & Electric Company, West Point, Neb.

Louis D. Gibbs, superintendent of the advertising department of the Boston Edison company, has been given a leave of absence to become associated with the statistical division of the War Industries Board, with headquarters at Washington. Mr. Gibbs is a past-president of the New England Section of the National Electric Light Association.

James T. Hutchings, vice-president and general manager of the Rochester (N. Y.) Railway & Light Company, has been appointed a member of the State Advisory Board in the United States Employment Service organization and as such will assist in the government labor distribution program. Mr. Hutchings was recently elected a director of the lighting company.

George L. Erwin has been appointed district manager at Grand Rapids, Mich., of the Consumers' Power Company, succeeding the late Samuel A. Freshney. Mr. Erwin was at one time president of the Grand Rapids Edison Company and manager of the Grand Rapids-Muskegon Power Company. In 1912 he became associated with the Michigan United Traction Company, with headquarters at Kalamazoo.

Obituary

William J. Waltham, a member of the electrical manufacturing firm of Henry Cole & Company, South Boston, Mass., died at Boston Oct. 7 as the result of an automobile accident. He was born in Chicago forty-three years ago and was a graduate of the Massachusetts Institute of Technology in the class of 1896.

Ely H. Norris, Morristown, N. J., superintendent of the test department at the plant of the Edison Storage Battery Company, West Orange, N. J., died on Oct. 6 at the Morristown Hospital, of pneumonia, aged twenty-seven.

Theron Pardee, who until his resignation in July to enter the Officers' Training Corps at Columbus Barracks, Ohio, was in charge of sales of automobile batteries in the Chicago office of the Electric Storage Battery, died of pneumonia on Oct. 5 at Camp Humphreys, Va., where he had been transferred to the Engineer Officers' Training School. Mr. Pardee was a graduate of the Lewis Institute, Chicago, and had been in the service of the company for three years.

Robert B. Corey, president of the R. B. Corey Company, New York City, and one of the pioneers in the supply sales branch of the electrical industry, died at his home in Plainfield, N. J., on Oct. 7 at the age of fifty-seven years. Mr. Corey, who had a host of friends, was particularly well known for his efforts to stabilize the electrical industry, to which work he devoted considerable time. "Bob" Corey, as he was familiarly known, will be genuinely missed at all meetings where electrical manufacturers or supply jobbers are wont to congregate. Mr. Corey was born in 1861. He entered Yale College with the class of 1882, but left before graduating to become associated with his father in the banking business in Bradford, Pa. In 1899 he entered the electrical industry as general manager of the Electrical Construction & Supply Company, New York. It was during his connection with this concern that he developed and placed on the market the Ward constant-potential arc lamp. He later went into business for himself under the firm name of the R. B. Corey Company. Mr. Corey was a member of a number of clubs and associations, including the Engineers' Club, the Machinery Club, the Plainfield Country Club, the Building Trades Association and the Merchants' Association of New York.

R. B. COREY

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

PRIORITIES ON EMPLOYED LABOR ARE DISCUSSED

Manufacturers of Dry Cells Meet Labor Board to Determine on Labor Assistance for One Plant Engaged on Important War Contracts

An interesting discussion on labor priorities, the first of its kind, was held last week in New York City under the direction of the New York branch of the United States Employment Service, Priorities Division, of which Dean Kirchway, Columbia University, is chairman. At that time the United Battery Corporation, which holds contracts for over a million dollars' worth of dry-battery parts for the Aircraft Production Board, stated that it was short of skilled labor and found that unless assistance was given in securing this labor it would be impossible to meet the government requirements on deliveries.

All of the other manufacturers of dry cells in and around New York were invited to appear before the Labor Priorities Board for a hearing. At this time it was shown that the battery parts were sent to France, where they were assembled. The parts had to meet certain other materials from the Middle West for shipment abroad at the same time, and consequently sufficient labor had to be supplied to meet these definite delivery dates.

The Priorities Board did not feel that it wanted to take men from other battery manufacturers, not having government contracts, except as a last resort. It was suggested by the board that a portion of these contracts should be placed with other manufacturers in such a way that delivery dates could be met without disturbing the personnel of the manufacturers. Some of the manufacturers at the conference readily agreed to this proposal. The matter is now under consideration at Washington.

Is case this is not found feasible by the Aircraft Production Board, then the Labor Priorities Board will find it necessary to request other manufacturers of dry cells to supply the United Battery Corporation pro rata, according to size and according to non-war production, with skilled workers. Thus those plants having the least essential production will be asked to contribute more heavily than the others to make up this labor deficiency.

"Our Country, 'Tis of Thee—"

JULY ELECTRICAL EXPORTS REACH A TOTAL OF $5,393,949

Motor Shipments Have Record Value of $943,006— Large Tungsten-Lamp Exports Also Figure in the Returns

Exports of electrical merchandise during the month of July last amounted to $5,393,949. This figure, while large in itself, is all the more surprising because of the extent to which shipping was utilized for war purposes.

Certain items stand out in the month's total. More so than any others is the item of motors, of which $943,006 worth were exported during July last. Another item is that of tungsten lamps, which had a value of $309,919 compared with $198,637 in July, 1917. Although this is more than 50 per cent increase in value, the total number of lamps exported was only 25 per cent more than in July of 1917.

During the first seven months of the current year the value of electrical exports amounted to $33,270,714 as compared with $32,428,145 in the first seven months of 1917 and $19,934,888 in the corresponding period of 1916. Based on the figures for the first seven months of the current year as printed here, the exports of electrical merchandise, should the same average be maintained for the balance of the year, are calculated to reach $56,600,000. While this figure is slightly larger than the record of 1917, it is exceedingly doubtful if the volume of goods exported will be as large. During the past year there have been numerous increases in the price of electrical products, and this condition should be carefully kept in mind when making comparisons of values. However, it is probably true that the volume of exports is greater to-day than prior to the war.

The accompanying figures were compiled from the regular monthly report of the Bureau of Foreign and Domestic Commerce.

Articles	July 1917	July 1918	Seven Months Ended July 1917	Seven Months Ended July 1918
Batteries	$290,312	$240,640	$2,137,716*	$1,815,658
Carbons	102,828	100,098	102,828	885,509
Dynamos and generators	96,057	283,407	1,456,192	1,937,064
Fans	41,245	105,823	379,036	651,971
Heating and cooking apparatus	23,295	64,823	23,295*	342,278
Insulated wire and cables	357,953	477,448	4,328,048	2,989,129
Interior wiring supplies, including fixtures	119,994	135,221	753,126	894,854
Arc lamps	1,962	524	11,736	7,188
Carbon-filament lamps	23,349	6,775	112,530	56,617
Metal-filament lamps	198,637	309,919	1,629,525	2,038,848
Magnetos, spark plugs, etc	269,941	151,821	269,941*	1,561,298
Meters and measuring instruments	68,630	236,019	626,320	1,172,626
Motors	411,687	943,006	3,693,938	4,326,199
Rheostats and controllers	14,201	18,730	14,201*	137,177
Switches and accessories	177,052	186,086	177,052*	1,390,106
Telegraph apparatus, including wireless	14,100	30,710	404,909	160,113
Telephones	180,937	296,970	1,269,936	1,740,661
Transformers	112,022	287,459	854,679	1,626,200
All other	1,325,164	1,518,470	14,183,137	9,537,218
Total	$3.829,366	$5,393,949	$32,428,145	$33,270,714

* Figures cover period beginning July 1.

Do You Help the Men Over There?

SMALL-ORDER BUSINESS IS DECREASING IN AMOUNT

Number of Orders on Jobbers' Books Is Smaller than Last Year, but Volume of Sales Is Practically the Same as Then

Data compiled on the volume of business done by electric supply jobbers in the first nine months of 1918 permit an observer to draw some interesting conclusions. The actual number of orders is less than for the same period of 1917, while the volume of sales is practically the same. Two causes may be assigned for this, namely, that the jobbers' plea to customers to reduce the amount of small-order business has been effective and that government activities are of such a nature as to centralize purchasing power in the hands of the "bigger buyers." Among the jobbers who have analyzed the data the first reason of the two is considered the more important. These wholesalers claim to have noticed many individual cases wherein contractors and central stations are coöperating with the jobbers to reduce the small-order evil. Not much assistance, however, is expected from industrial plants, principally for the reason that they buy largely on requisition.

THE WEEK
IN TRADE

NO REDUCTION in the peak demand for electrical goods can be noticed. The difficulty of supplying this demand, however, is becoming much greater. Stocks generally are lower, and the curtailment of output in many lines will naturally heighten this condition. War business is dominating the industry, and as stocks of non-war material become lower the industry will approach the 100 per cent war-work mark. In the meantime those supply men operating in districts free from war demand will, unless stocks can by some means be kept up, be obliged to suffer a reduction in volume of business.

The Spanish influenza is making considerable inroads upon the industry. Production has as a result suffered, and distribution has been slowed up somewhat. As a result of the epidemic the jobbers' convention scheduled for next week has been postponed.

Prices are still virtually stationary. Collections appear to be holding up well at present.

NEW YORK

Business in the past week has been particularly brisk. Stocks on hand in nearly all lines are exceedingly low. The War Industries Board, as part of the general program for the conservation of material, labor and transportation, has placed additional curtailment on the manufacture of articles not essential to the prosecution of the war and announced on Oct. 10 that during the six months' period from Oct. 1 the manufacture of electric heating appliances will be curtailed to 50 per cent of six months' production during 1917. This, coming as it does on a market practically bare of these stocks, is bound to create an acute shortage. The influenza epidemic in many cases is proving a serious factor in slowing up production. Health officials appear to have checked the disease in the East, and it is hoped that it has nearly run its course.

RADIATORS.—An acute shortage of radiators and all heating appliances has suddenly developed in the market owing to the greatly increased demand caused by the epidemic of influenza and by the recent cold weather. Distributers' stocks on hand are now very low, and deliveries are from five to six weeks behind time.

VACUUM CLEANERS.—Demand in the past six weeks has been very brisk and stocks on hand are very low. Shipments are from a month to six weeks behind. Prices remain about the same with the large dealers. Some slight advances have been made by some of the smaller manufacturers.

WASHING MACHINES.—Owing to the problem of domestic help the washing-machine demand is still increasing. Stocks on hand are very low and shipments poor. Prices have not been advanced in the past month by the large makers, but discounts have shortened.

IRONING MACHINES AND MANGLES.—Demand has heightened during the past month with an advance of about 10 per cent in price. Production has been greatly curtailed for lack of metal essentials, and shipments are very slow, deliveries being about six weeks behind.

ELECTRICAL TOYS.—The manufacture of electrical toys is practically at a standstill through the difficulty of obtaining metal. Only those who had supplies on hand can deliver. No new contrivances are being brought out now, and the industry has turned its attention almost wholly to war work. Stocks on hand in some lines are fair, and prices have not been advanced since last August, when they increased 30 per cent.

LIGHTING FIXTURES.—Large war orders for glass placed with the manufacturers of lighting fixtures have curtailed the output of bowls, basins, shades, etc., considerably. In fact, the production of many decorative styles has ceased entirely. Stocks on hand generally speaking are low. Prices on lighting fixtures have been steady for some time.

FUSES.—Stocks on hand, so far as could be learned, are low, and one jobber reports that it is extremely difficult to fill orders.

PORTABLE LAMPS.—The demand is increasing. There was a slight advance by jobbers last week on the price of table lamps.

SOCKETS.—Business continues good. Supplies on hand are low and shipments are delayed. Few deliveries are being made outside of war orders.

MOTORS AND GENERATORS.—The large manufacturers of motors report an exceedingly good demand. Shipments are slow and stocks on hand pretty well exhausted. No price changes have occurred in the past month.

WIRE.—The situation in bare and weatherproof wire remains practically the same with no price changes since last month.

INSULATION.—The epidemic of Spanish influenza is being felt seriously in the industry. In one plant 50 per cent of the force were sick, and in another instance a plant had to close down for two days. No price change is reported since Sept. 15.

CONDUIT.—There has been no change reported. Conditions governing metal molding are practically the same as for iron pipe. Manufacturers report they cannot supply the demand and that stocks are very low. Only priority orders are being filled at this time. Prices of conduit have not advanced recently.

CHICAGO

It is considered a misfortune that the jobbers' convention at Cleveland called for Oct. 21, 22 and 23 had to be postponed on account of danger from the influenza. This meeting was expected to clear up many troublesome questions on the "pledge system." The chief job of the jobbers' salesmanager now is to answer the queries of salesmen and customers who want to know if such-and-such a product can be sold to Mr. So-and-So to use in a certain way. Jobbers are beginning to express a desire that some of the manufacturers publish in their trade advertising "copy" of a sort which will help educate the dealer as to what is a proper and what is an improper retail function. The statement is made that it is becoming harder to do business every day, not because the material situation is basically worse, but because of the extraordinary amount of education necessary in the trade.

TOOLS.—Heavy tools, such as shovels, pike poles, etc., have advanced about 20 per cent in price.

TELEPHONE WIRE.—On account of the government's demand for small wire the price of telephone wire has increased.

RUBBER-COVERED COPPER WIRE.—This class of wire is scarce to a point which has had a tendency to increase the price. The situation is said to be really critical in No. 14 single-braid. The cause for the scarcity can be readily understood when it is stated that the government has stated it wants 25,000 miles of outpost wire every month for one year. To produce this amount the machines of thirty-two wire manufacturers have been placed on the job on a twenty-four-hour-a-day basis. One of the largest manufacturers of small-sized wires by placing all of his small braiding machines on the job twenty-four hours a day can only turn out 1000 miles a month. It is difficult to conceive of a single purchaser taking enough wire each month to encircle the earth once. That, however, is what is causing the scarcity. As the result of this some jobbers feel that any one who has a stock of rubber-covered wire is entitled to almost any price he sees fit to ask for it. This has been the basis of some price changes. Other jobbers

have increased prices in order to hold their existing stocks for regular customers. Still others believe that they should sell what stocks they have at a fair profit and not try to take advantage of this bad situation to take an extra long profit. This difference in ways of viewing the problem has led to a rather scattered price situation.

WEATHERPROOF WIRE.—Weatherproof wire is on a 36-cent base, due entirely to the cotton prices. Stocks are plentiful.

BELL-RINGING TRANSFORMERS.—One manufacturer is producing 10,000 of these small units a month and is behind on orders. The increasing price of dry cells is looked upon as a large factor in creating demand for these goods. The output of toy transformers has been curtailed.

MICA.—A Chicago concern with six carloads of stock en route has already sold the entire lot. This is indicative of the conditions of supply and demand in this field.

FARM-LIGHTING PLANTS.—The business in both the retail electrical and retail automobile fields is reported to be good. Jobbers who sold large quantities of these plants to dealers in August just before a price increase are beginning to see the cash for them come in.

SPECIALTIES.—In this class of goods one of the best movers at present is the heat regulator, sales of which are mounting daily.

CONDUIT.—A customer with a good priority order can get conduit of almost any size by persistent shopping around. The shopping process is necessary, however.

BOSTON

The volume of trade continues to show a decided falling off compared with two weeks ago. The grip epidemic appears to have passed its height, and the outlook is now much more encouraging for the restoration of something like normal office and factory forces. Strenuous efforts on behalf of the fourth Liberty loan are being pushed to completion this week. Office staffs of jobbers and distributers are hard-pressed to fill business already on the books, and in many cases it is probably true that if no new orders were received for a month there would still be enough to occupy the time of jobbing organizations in meeting established needs. Prices are showing little change this week, but the friction tape supply is running short, and a further advance would not be surprising at any time. Jobbers are well stocked with slow-moving products and supplies and are running rather lower on fast-moving material. Collections are fair. Deliveries are better, though there is still room for improvement. A great deal of quiet campaigning for wiring material and fixture sales in connection with the government housing program is under way. Little is heard as yet about Christmas trade in jobbing circles, but it is expected that there will be some movement in fuel-saving appliances and in labor-saving equipment associated with the holiday season.

WASHING MACHINES.—Stocks are low and retailers could dispose of many more machines if available. The rationing system severely restricts sales, and in some cases the volume of trade is but 25 to 35 per cent of what might easily be realized if the machines could be had.

VACUUM CLEANERS.—These are moving well, but sales are considerably below the maximum. This is due to the limited supply of equipments rather than to a falling off in popular interest.

LAMPS.—Stocks are getting back to normal, barring a long-continued shortage in miniatures due to war requirements. One large manufacturer reports a stock of more than 1,000,000 lamps of diverse sizes and types at Boston. The governmental edict regarding metallized filament and carbon lamps is being well received. Practically all New England central stations have now discontinued free renewals of metallized-filament lamps. It is expected that a new tungsten lamp in two sizes, 25 watts and 50 watts, specially designed to meet the conditions of rough service, will soon be introduced into New England manufacturing plants.

MOTORS FOR TEXTILE PLANTS.—Business is reported to be in good volume, although not as much new work is being done as hitherto. Motor manufacturers are offering somewhat better deliveries, subject, however, to extensions by circumstances beyond their control. Prices show little change. There is not much accumulation of motor stocks at the factories, nor is there likely to be in the face of present demands for steel and cotton. Comparatively little so called "efficiency work" in the redesigning of textile-plant motor drives is being done at present, but trade is in good volume in motors specially designed for textile-plant service.

SCHEDULE MATERIAL.—Stocks are about normal at present.

RADIATORS.—The market continues oversold. A recently received consignment lasted the jobber into whose hands they went less than one day. The manufacturers will be busy for some time filling orders now on the books, and the existing shortage bids fair to become still more acute with the advent of colder weather.

WIRE AND CABLE.—Practically no rubber-covered wire in small sizes is now available for general marketing. Local prices on government orders are running at from $11 to $12.50 per 1000 ft. in No. 14. Delivery is the principal factor in the wire market. The government is buying immense quantities of outpost wire, and until these orders are filled the civilian trade must wait. Weatherproof wire is quoted at 32 to 35 cents, according to delivery. One recent order of No. 14 rubber-covered wire for outpost work totaled 1,000,000 ft. at $12.25 per 1000 ft. Jobbers are endeavoring to buy small wire for future use in some cases, but without much success.

FIXTURES.—Old-established houses report a fair business from long-time custom. Prices show little change. A good deal of "gumshoe work" is being done at present in connection with housing proposition orders, but neither jobbers nor dealers are inclined to announce their successes in bidding, probably because not a little competitive work is still to be awarded.

FRICTION TAPE.—The situation is getting acute, with increasing scarcity of material. The number of grades has been cut down about 50 per cent, at the suggestion of the government. White tape is no longer being produced in some plants. Prices are high and a further advance would not be surprising.

ATLANTA

On the whole the demand for all staples remains steady, and there is very little change to be noted in the past two weeks.

The Atlantic Refining Company, Philadelphia, has consummated a deal whereby one of the largest oil refineries will be established at Brunswick, Ga.

The Ocmulgee River, Georgia, on which the Central Georgia Power Company's plant is situated, has reached a very low stage, and a very drastic power curtailment order has been issued by the War Industries Board. Industries will be closed down from 7 a.m. to 10 a.m., and street cars will not be operated between 9 a.m. and 11 a.m. and from 1.30 p.m. to 6 p.m. A like order has been issued for Atlanta, where all industries using more than 5 hp. shall use power from 7 a.m. to 12 noon only. Opinions vary as to the effect of the passage of the so-called emergency power bill on power companies affected by drought.

The Georgia Railroad Commission has declined to take action on the Southern Bell Telephone Company's petition for an increase in rates, since the government took over the control of the company. The commission has allowed the Augusta-Aiken Railway & Electric Company to increase fares from 5 cents to 6 cents and the Montezuma Electric Company to charge 15 cents net per kilowatt-hour for energy. A petition from the Athens Railway & Light Company will be heard shortly.

The Alabama Public Service Commission has granted an increase in street-car fare from 5 cents to 6 cents to the Anniston Traction Company, the Mobile Electric Company and the Montgomery Traction Company.

SEATTLE—PORTLAND

The past week showed no marked increase in electrical business transacted, both jobbers and dealers reporting sales well sustained. Sales to the Puget Sound Navy Yard at Bremerton were a shade heavier. Cantonment business, especially along the line of lamps and wiring devices for improvements and extensions, also shows a slight increase. Seattle jobbers particularly report a slight decrease in the sales of large motors and heavy power apparatus, but as these sales fluctuate more or less little concern is manifested. The Northwest jobbers and dealers have signed pledges to furnish no material unless it is for essential war work. The pledges were signed freely and are being lived up to religiously.

Shortages heretofore mentioned, including larger-sized wire, motors, higher wattage lamps, etc., are becoming more acute. Washing machines, which have been coming through from manufacturers in a fairly satisfactory way, have dropped off in supply and a shortage is threatened which will strike quite hard. Sales, which have been excellent, are not materially diminishing. Northwest jobbers naturally will be hard hit when additional curtailments in manufacture of articles not essential to prosecution of the war become effective. It is noted that curtailments have been made in the output of electrical heating devices and sewing machines, among other things. The former were in heavy demand last fall and winter, and this year's sales were expected to be equally satisfactory. Sewing machines have moved well all year and with continued prosperity were expected to increase. Local jobbers understand that Christmas tree outfits will not be manufactured to any extent this year. The effect will not be noticeable as the Northwest trade has not been extensively educated to this luxury.

The Spanish influenza epidemic in the Northwest is becoming more serious daily and retarding business considerably. Theaters and schools are closed and public gatherings have been forbidden. Traction companies in the larger cities, especially Seattle and Portland, as a result are suffering heavy financial losses. Shipbuilding is being retarded owing to the number of cases among employees. Electrical jobbers and retailers have not gone untouched.

Seattle is going ahead with its seven-million-dollar building campaign. Priority certificates covering materials for the first allotment of 1500 homes for Seattle will be issued immediately. Further allotments are assured. Excellent progress is being made relative to housing conditions in Portland. A blanket permit for 1000 homes has been received and construction work on these will be started immediately.

Portland jobbers report that business during the past week was good, although there was no marked activity along any special line. The bulk of the business was carried on with plants engaged in war work. The Pacific Coast Steel Company, Portland, signed contracts for the erection of the first buildings of a large steel plant. The Columbia Iron & Welding Works, Astoria, will make immediate enlargement of plant. Although the bond drive exceeds all others in intensity, collections are highly satisfactory.

SAN FRANCISCO

The past week has been one of very light business, in which the effect of non-essential building orders has been accentuated by the fact that most jobbers and salesmen have been personally canvassing for the sale of the fourth issue of Liberty Bonds.

Some very big shipbuilding operations, notably those of the Liberty Shipbuilding Company and the Parr-McCormack Steamship Company, are practically past the paper stage, and big business is expected.

WIRE.—Local stocks of standard sizes are very good, especially in the house-wiring sizes, Nos. 14 and 12, and the larger sizes, such as Nos. 6 and 8, as emergency wiring for electric ranges in new industrial quarters. It is difficult to secure any sort of telephone wire, whether outside or inside. Big shipments have been made to the government for service in France. Particularly is this so in the case of No. 17 copper-clad wire, of which about 4,000,000 ft. has been shipped from the Pacific Coast in the past four weeks.

TELEPHONES.—Very little business is reported, and this is in the nature of maintenance and repairs and mostly for items such as batteries and wire instead of the telephone devices. Interphone business, except in big industrial factories, will be wiped out by essential building regulations, and telephone extensions in large cities will be affected by the new government tax, varying from $5 to $15 for every telephone installed even with a minimum of labor.

HEATING DEVICES.—It has been announced that factories making small electrical devices will be asked to cut their output one-half. Further advices are eagerly awaited by Pacific Coast electrical men. Big stocks are ordered or are on the way to replace certain large shipments because of advances in price, and unless orders on factory files are immediately filled, the Pacific holiday trade in such goods will be badly cut.

RANGES.—There are so many essential jobs, such as those at Baypoint, Cal., and Seattle, Wash., and so very little private business on account of the power companies' inability to deliver energy that business will probably go on as before with the exception that some newly awakened Hawaiian business may be indefinitely suspended.

METAL MARKET SITUATION

Copper Imports Reach Record Figure—Reduction in the Price of Tin

Importations of copper in September were phenomenally heavy; in fact, they were the largest for any single month in the history of the industry. The total, according to Custom House reports made through the Metal Exchange, was 71,680,000 lb. Average monthly importations during June, July and August were a little less than 45,000,000 lb., and the average monthly arrivals since the first of the year have been 47,110,000 lb.

In regard to prices no new developments were noted last week. The market is bound to be quiet as 90 per cent or more of our entire output is going into consumption for the war requirements of ourselves and our allies. It is reported that a meeting of the producers and the War Trade Board is called for Oct. 25 to arrange for price to rule after Nov. 1.

The London price on tin on Oct. 15 was £335 for standard prompt and future, and £335 10s. for Straits, which is a reduction over last week. The Singapore price is not allowed to be divulged, but it is possible there may be a modification in this respect before very long when the allied nations' control arrangements get into full swing.

NEW YORK METAL MARKET PRICES

	Oct. 8	Oct. 15
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	8.05	8.05
Antimony	14.00	13.62½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.10	9.00
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.00	23.50 to 24.00
Brass, heavy	14.00 to 14.25	14.00 to 14.25
Brass, light	11.50 to 12.00	11.00 to 11.50
Lead, heavy	7.50 to 8.00	7.50 to 8.00
Zinc, old scrap	6.50 to 6.75	6.00 to 6.25

*No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 0-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20% to $73.20
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20% to $85.20
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .329

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
1/2-in. single trip	$75.00	$63.75— 69.75
1/2-in. double strip	75.00— 82.50	72.00— 75.00
3/4-in. single strip	100.00	85.00— 93.00
3/4-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
1/2-in. single strip	$75.00	$63.75 to $64.25
1/2-in. double strip	78.25 to $90.00	71.25 to 75.00
3/4-in. single strip	100.00	75.00 to 85.00
3/4-in. double strip	105.00 to 120.00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05½	1	$0.25
1/2	.06	1 1/4	.33
3/4	.09	1 1/2	.40
3/4	.12	1 3/4	.47
3/4	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$25.00–51.70	$24.60–35.20	$23.00–30.25
1/2-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$44.00–60.00	$30.00–33.00	$26.50–29.15
1/2-in.—	48.00–65.00	32.50–36.00	29.00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08½
3/8	.08½
1/2	.08½
3/4	.11½
1	.17
1 1/4	.23
1 1/2	.27½
2	.37½
2 1/2	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	7% to 7.1%	9% to 9.1%
2500 to 5000 lb	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 6.8%	+3.5% to 8.8%
2500 to 5000 lb.	+2.5% to 10.7%	+5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	20% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $9.37
1/5 to std. pkg	5.25 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.47—$40.77
Coil to 1000 ft	27.42— 30.22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20% to 30%	10% to 20%
$10.00 to $50.00 list	30% to 40%	20% to 30%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $24.00
1/5 to std. pkg	17.85 to 20.40

Standard package, 2200. List per 1000, $21 to 24

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16.80–24.15
1/5 to std. pkg	15.80–21.00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00 to $22.00	$32.00
1/5 to std. pkg	13.60 to 18.70	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70–$24.00	$33.85–$35.80
1/5 to std. pkg	10.15– 20.00	26.60– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to 10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$15 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to 30%
$2.00 to $10.00 list	10% to 35%	5% to 40%
$10.00 to $50.00 list	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to 6.50
Discount	20% to 30%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.51–$0.66
No. 18, full spools	.49– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.72
No. 18, full spools	.55 to .605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25.00	$15.00–$17.00	$15.00–
12	23.58– 27.09	21.62– 29.09	17.68– 23.22
10	30.20– 37.80	27.45– 32.40	23.47– 32.40
8	42.74– 53.34	38.85– 45.72	33.21– 45.72
6	61.50– 84.42	55.35– 72.36	52.58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22.00–$25.00	$18.00–$22.00	$15.50–$16.50
12	29.46– 31.44	29.46– 31.44	25.54– 31.44
10	41.10– 43.84	41.10– 43.84	34.62– 38.36
8	57.00– 61.76	57.90– 61.76	50.18– 54.04
6	85.31– 97.68	85.31– 85.47	72.21– 85.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39.75 to $44.00
25 to 50 lb	39.75 to 42.00
50 to 100 lb	38.75 to 40.00

CHICAGO

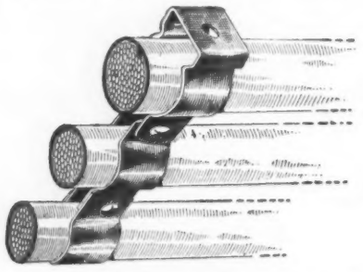
	Per 100 Lb. Net
Less than 25 lb	$37.00 to $41.75
25 to 50 lb	36.00 to 40.00
50 to 100 lb	35.00 to 39.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Cable and Conduit Hanger Saves Time

Where parallel cable or conduit runs are to be put up, the Minerallac Electric Company, 1045 Washington Boulevard, Chicago, claims its new multiple hanger will prove a considerable time saver. With these units two, three or more lines of iron conduit or cable can be suspended from the same set of toggle or expansion bolts, thus saving the expense of drilling duplicate lines of holes and using extra toggle or expansion bolts. The new hanger consists of



NEAT AND CONVENIENT HANGER FOR SUSPENDED CABLE RUNS

three types of clips. The first is the regular Minerallac hanger, which has been on the market for some time. The second is an intermediate clip which attaches to the regular hanger and also has bolt holes for supporting the third or terminal clip. Another advantage of these devices is that additional lines of conduit or cable can be added to existing runs without great expense. Porcelain bushings can be used with cable in the intermediate and terminal pieces just as they are used in the regular hanger. Regular hangers are made in sizes between ⅜ in. and 2½ in. (9.5 mm. to 63.5 mm.); intermediate hangers are made in sizes from ½ in. to 2½ in. (12.7 mm. to 63.5 mm.), and terminal hangers are made in ½-in. and ¾-in. sizes (12.7 mm. to 19 mm.). The Underwriters' Laboratories and the Chicago Department of Electrical Inspection have approved the hangers.

Fiber Fuse Plugs

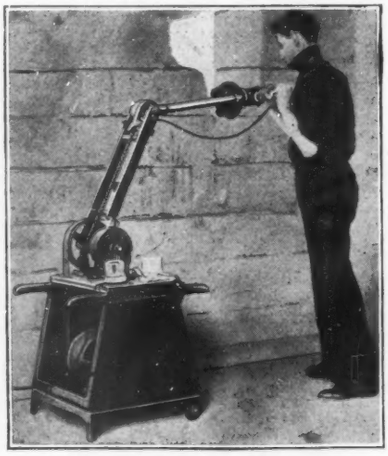
Fiber has been substituted for porcelain in a fuse plug being placed upon the market by the Chelten Electric Company, 4859 Stenton Avenue, Germantown, Philadelphia, Pa. This plug is made in standard capacities up to and including 30 amp. and has been approved by the National Board of Fire Underwriters. The fuses are much lighter in weight, the makers say, and fuse wires make a permanent connection, the wire itself being tested and the fuse so calibrated that it will blow in accordance with the Underwriters' recommendations.

Tumbler Switches

Quick make-and-break mechanism is the feature of the tumbler switches manufactured by the Duncan Electrical Company, Ltd., Montreal, Canada. The base of this device is the same size as with the standard 5-amp. switches and can be easily attached to every standard fitting. Wire holes in the base are sufficiently large to allow the loom to enter. The binding posts are according to the new code and the contacts are double, making the latter positive. The switch is very low in height and presents a neat, serviceable appearance, according to the makers.

Motor-Operated Rubbing Machine

To meet the demand for a speedy machine with a good range of action for rubbing and polishing side walls, columns, bridges, subways, etc., the Cavicchi Polishing Machinery Company of Quincy, Mass., has developed a portable motor-operated machine said to do the work of ten manual laborers.



SPEEDY MACHINE WITH WIDE RANGE OF ACTION

The rubbing wheel is on a jointed arm and has a radius of action of 6.5 ft. (2 m.) vertically from the floor and 8 ft. (2.4 m.) horizontally. The rubbing wheel and the water pump, which eliminates dust, are driven by a motor made by the General Electric Company, Schenectady, N. Y.

Springs in the arm counteract its weight and keep the carborundum wheels of the various kinds suitable for different classes of work pressed against the wall regardless of its irregularity. An ample supply of water is provided by a reservoir in the body of the machine.

Fittings for Double Push-Button Switches

Fittings that have been designed as a means of protection for push-button switches against vapor, gas and dust

PROTECTION AGAINST VAPOR, GAS OR DUST

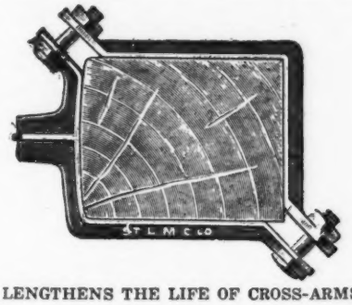
have been brought out by the Appleton Electric Company of Chicago, Ill. The bodies have four ears, to which a cover is fastened, and as the cover is flanged, the fitting is absolutely vapor-proof, it is claimed. The cover is furnished complete with stems, and one button has a white insert so as to show whether the current is on or off. Gaskets and necessary fastening screws are furnished with the cover. This is known as the "GEP" series of "Unilet" bodies.

Insulating Cement

Quick motor repair by means of an insulating cement called "Porce-Lute" is being manufactured by Wilkins U. Greene, Ridgewood, N. J. With this cement, it is said, pitted commutators can be repaired without facing, and flashing over can be stopped. It is suitable, besides, for general use on all electrical work. In addition, it will repair porcelain and other articles not affected by heat. Dried in the air, this material will neither expand nor contract, and it is not affected by high heat, say the makers. It is very useful in curing trouble with collector rings in alternating-current machines and for insulation in places that cannot be reached with tape or other forms of insulating material. If, after applying the cement, the articles are placed in a warm place, the cement will harden in a short time, this depending on the amount of cement used. "Porce-Lute" insulating cement hardens to a glassy hardness resembling porcelain.

Clamps for Wood Cross-Arms

Clamps manufactured by the St. Louis Malleable Casting Company, St. Louis, Mo., for attaching insulators to cross-arms are asserted by this company to be very strong. These clamps will lengthen the life of the wood arms many times, the makers say, because they strengthen arms whereas holes bored in the arms for attachment weaken them. These clamps are adjustable and will fit any arms 3 in. to 3½ in. (76 mm. to 89 mm.) wide or 4

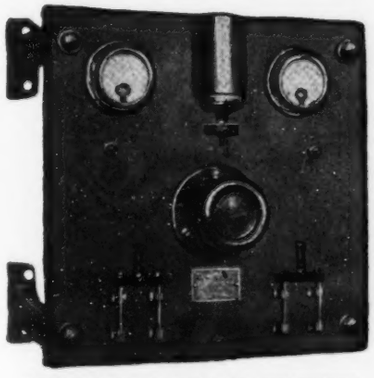


LENGTHENS THE LIFE OF CROSS-ARMS

in. to 4½ in. (101 mm. to 114 mm.) high. This attachment also provides a simple and inexpensive means of repairing arms that have been split by a strain on the wires or by the action of the weather, thus saving the cost of new arms. The attachments designed to support a screw-type insulator are equipped with the "Ette" patent insert head, whereby all liability of insulator breakage arising from unequal expansion and contraction present in ordinary metal insulator supports is overcome. These cross-arm attachments are made in various forms and weights to meet every requirement of telephone, telegraph, electric light and power and electric railway line necessities.

Automatic Battery-Charging Panels

Automatic cut-in and cut-out switches which will not close the charging circuits until the generator voltage



AUTOMATIC PANEL FOR CHARGING BATTERIES

has reached the proper value and which will open the circuits immediately upon reversal of the current are features of battery-charging panels made by the General Electric Company of Schenectady, N. Y. These panels are furnished for 1250, 1500, 2000 or more watts and for 35 volts. They are made of black marine-finished slate and are arranged for wall mounting. The proper generators for use with this panel are also furnished by the company.

Device Simplifies Meter Reading

An improved meter-reading and recording device for attachment to the ordinary house-type Westinghouse single-phase watt-hour meters has been brought out by the Economy Appliance Company of Waterloo, Iowa. The device is easily applied to these meters, the change being made by removing the old cover and replacing it with the new one, which has the device mounted upon it. The ordinary pointer hands are also removed and are replaced by hands with knife-blade attachments. To read his meter the customer inserts a card in a slot provided for the purpose, turns the lever at the side of the meter and withdraws the card. Turning the

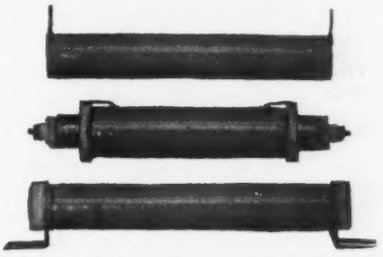
SPECIAL COVER AND HANDLE FOR RECORDING METER READINGS

lever marks the position of the knife-blade hands upon dials printed on the card so that this record can be mailed to the central-station office.

Enameled Resistance Units

Enameled resistance units for regulating current have been developed in various forms and sizes by the General Electric Company of Schenectady, N. Y. Some of the applications to which these units have been put are railway and fire-alarm signals, fractional-horsepower motors and locomotive headlights. They are also used in series with relay, contactor and circuit-breaker coils on panels and switchboards. They are made to be particularly applicable in mines and similar places where a great amount of moisture is present. It is said that these units are unique in their ability to withstand unusually high temperatures as well as sudden changes in temperature from one extreme to the other. The resistance wire or conductor is wound upon a steel body coated either with a special refractory enamel or paint and high heat-resisting silicate compound. The steel body is preferred for extreme lengths where strength for a long span is required and is stated to be especially serviceable where the unit might be subjected to severe vibration or shock.

The refractory silicate body is used for most of the ordinary types of resistance. The manufacturers say that the compound employed is far superior to porcelain or any equivalent ceramic



STANDARD UNITS OBTAINABLE WITH DIFFERENT METHODS OF ATTACHMENT

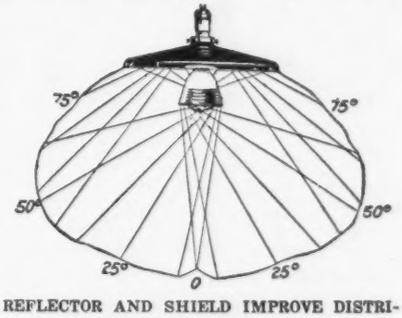
products, which are easily cracked or weakened mechanically by repeated and extreme temperature fluctuations. These units have been standardized but may also be obtained in special forms.

Push-Button Flush Switch

Because these switches are very shallow, being only 1 in. (2.5 cm.) deep, they are provided with an easy, short ⅜-in. (9.5-mm.) push. No pins or bushings can work loose according to the makers, because of the rigid construction of the parts. Outside of the bearings all parts are riveted firmly together. This is known as No. 200 single-pole or 203 three-way switch of the Duncan Electrical Company, Ltd., Montreal, Canada.

Lamp Shield Minimizes Glare

In addition to a porcelain-enamel metal reflector for properly directing the light distribution a shield may also be used for prevention of glare. Such a combination of devices is made by L. Plaut & Company, 432 East Twenty-third Street, New York City. The dis-



REFLECTOR AND SHIELD IMPROVE DISTRIBUTION AND REDUCE GLARE

tribution obtained from the combined reflector and shield with a 110-watt gas-filled lamp is shown in the illustration, affording fairly uniform illumination under the lamp.

Trade Notes

PROCEDURE GOVERNING EXPORTS TO SWEDEN.—The War Trade Board announced on Sept. 23 the adoption of regulations governing the procedure with respect to the issuance of licenses for the exportation of commodities to Sweden. Former announcements with respect to such regulations (W.T.B.R. 191, Aug. 9, 1918) are withdrawn, and the new regulations adopted may be found in W.T.B.R. 236.

VALIDITY OF FRENCH IMPORT LICENSES.—The term of validity of all import authorizations and licenses has been increased to six months. This measure applies to all existing authorizations and licenses. Licenses which have expired, being more than three months old, and the renewal of which has not been applied for, are extended under the new regulations up to the expiration of a term of six months from their respective dates.

EXHIBITION OF INVENTIONS, DESIGNS AND TRADEMARKS IN JAPAN.—The Department of Agriculture and Commerce of Japan has decided to hold an exhibition of inventions, designs and trademarks in the coming fall. Important inventions, designs and trademarks will be exhibited. The exhibition is now being held at Uyeno Park, Tokyo, from Oct. 10 to Nov. 30. Many important electrical inventions among others will be given publicity at the exhibition.

LIBERTY BOND NOTES.—Employees of the Splitdorf Electrical Company, Newark, N. J., have subscribed $125,000 to the fourth Liberty loan. Employees of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., have arranged a quota of $5,000,000 for the fourth Liberty loan and have subscribed over $4,423,800 of this amount. Employees of the Union Switch & Signal Company, a subsidiary organization, with a quota of $579,000, have subscribed $609,000, exceeding their quota.

REGULATIONS GOVERNING EXPORT TO DENMARK.—The War Trade Board announces that, in consequence of the conclusion of a general commercial agreement with Denmark, applications for licenses to export all commodities (with the exception of cereals and fodders) to that country are now being considered. Previous announcements with respect to exports to Denmark are withdrawn. Exporters should apply for licenses to the Bureau of Exports, Washington, D. C., using Application Form X, attaching thereto Supplemental Information Sheet X-105 and such other supplemental information sheets concerning the commodity as are required.

EXPORTS TO RUSSIA.—The War Trade Board announces, in a new ruling (W. T. B. R. 257) that applications will now be considered for the exportation of all commodities to Russia. Exporters are requested to file their applications with the Bureau of Exports, War Trade Board, Washington, D. C. A limited amount of cargo space may be available for shipments from the Pacific Coast direct to Vladivostok, and in allocating space preference will be given to material covered by licenses issued on and after Oct. 7, 1918, under conditions which the War Trade Board in Washington is prepared to define and discuss with exporters, giving due consideration to the particular transactions in question. In order to facilitate the consideration of applications, exporters are requested to state definitely on each application whether or not the material is made up and ready for shipment, and, if so, the location thereof.

LARGE DEVELOPMENT IN SWEDISH MANUFACTURE OF ELECTRICAL GOODS.—At the Goleborg (Sweden) fair, July 8 to 13, the first exhibition of Swedish industry since the outbreak of the war, goods from all parts of Sweden and of many kinds of manufacture were exhibited. In speaking of the electrical exhibits the *Svenska Handelstidning* said: "The manufacture of electrical material has grown enormously during the war. In a number of articles, especially installation material and armature, foreign competition had the upper hand before the war, and at the prices then prevailing there was no chance for Swedish manufacture. Now Swedish manufacture has taken the market entirely, owing to increased demand, the disappearance of foreign competition and the change in prices. Before the time when foreign competition will again have to be met Swedish manufacturers should be able to meet it. Even electrical measuring instruments, which formerly were made only abroad, were exhibited at the fair, but these are not yet perfect."

IMPORTATION OF VARNISH GUMS RESTRICTED.—The importation into the United States of varnish gums is restricted as to shipments made after Oct. 10, 1918. All outstanding licenses have been revoked as to ocean shipment after that date and no new licenses will be issued except to cover the following: (1) Shipments made from abroad on or before Oct. 10, 1918; (2) shipments for the use of the United States government; (3) shipments from Mexico or Canada by other than ocean transportation; (4) shipments from Europe or Mediterranean Africa when coming as return cargo from convenient ports where loading can be done without delay; (5) shipments of copal or manila gum when shipped from the Philippine Islands, and (6) shipments of Kauri gum not to exceed a total of 3,000,000 lb. during the calendar year 1918. Licenses for the amounts of varnish gums permitted to come forward, pursuant to the foregoing, will be allocated by the Bureau of Imports of the War Trade Board in accordance with the recommendations as to distribution and price of the War Industries Board.

EXPORT LICENSE.—The War Industries Board and the War Trade Board announce in a new ruling (W.T.D.R. 258) that they have jointly adopted rules and regulations for the purposes of simplifying the procedure of obtaining export licenses from the War Trade Board, priority certificates from the Priorities Committee of the War Industries Board and permits from the Director of Steel Supply of the War Industries Board. This refers to iron and steel products, and on and after Oct. 14, 1918, applications for licenses to export these articles should be filed with the War Trade Board. The Priorities Committee of the War Industries Board has awarded priority classifications to all articles on which priorities are issued which are on the export conservation list of the War Trade Board and are covered by export licenses issued on and after Oct. 16, 1918. No certificates will be issued with such licenses. If the article specified on the license is one on which priorities are issued, and if no individual priority certificate accompanies the export license, the license itself will be evidence that the article covered by it has been automatically awarded priority classification.

EXPORTERS' ENCYCLOPAEDIA.—The fourteenth (1918-19) edition of the Exporters' Encyclopaedia, which has just been issued by the Exporters' Encyclopaedia Company, 80 Broad Sreet, New York City, should be of great value to the American manufacturer who is getting his first experience in handling export inquiries and orders, as it covers, every question that comes up in making an export shipment, from the initial step of packing to the arrival of goods at final destination. The arrangement of the information is such that all the shipper needs to know is the country or port to which the goods are to be shipped. The various regulations that apply as to packing, documentation, etc., are covered separately for each country, thus preventing confusion. Every practical shipping route from the United States is shown for each country; also the frequency of sailings, loading piers and other data required by the shipper. Fac-similes of the consular documents required, with translations into English, are shown; also the costs of certification, etc. A series of maps (sixty-four all told)—separate maps being shown for each country or grand division—is also a valuable feature. With the encyclopaedia at hand, an American manufacturer can direct his export business without danger of fines for non-attention to important custom-house details that must be observed and with full satisfaction to his foreign customers.

BOSCH MAGNETO PLANT ACTIVE IN WAR WORK.—Until a few months ago the Bosch Magneto Company, Springfield, Mass., was enemy-owned and controlled. It had built a strong business throughout the United States during the few years of its existence here, and its progress kept pace with the swift growth of the automobile industry. While the United States was at peace it was neither possible nor practicable to take official notice of the fact that the company was out of sympathy with the Allied cause. The United States could not then prevent the company's refusal to sell to motor manufacturers whose products were going to the Allied armies. The prosperity of the concern accordingly was based on its sales for domestic use of magnetos. Control of the company is now in the hands of the Alien Property Custodian. The company is working for Uncle Sam with might and main, and 85 per cent of its output is going into the equipment of the United States Army and the armies of our allies. Seventeen out of every twenty magnetos made by this company are going into service on motors for trucks and airplanes, to transport our food and ammunition from the French bases to the front, and to send our aviators up and over the battle lines. As a recent press advertisement puts it, "The Bosch is carrying our war to the Boche." Every dollar of profit Uncle Sam makes from the manufacture and sale of the Bosch magneto is being invested at once in Liberty bonds.

THE CUTLER-HAMMER MANUFACTURING COMPANY of Milwaukee has moved into its new factory buildings.

THE ACME WIRE COMPANY, New Haven, Conn., has awarded the contract for a 30-ft. by 60-ft. two-story addition to its plant.

Y. A. VOWELL, formerly with the Vancouver (B. C.) branch of Crane Limited, is now in charge of the company's new office at 402 Lumsden Building, Toronto, Canada.

HORACE N. TRUMBULL, advertising manager of the S K F Ball Bearing Company of Hartford, Conn., has entered the reserve officers' training camp at New Haven, Conn.

THE CHICAGO PNEUMATIC TOOL COMPANY of Massachusetts announces the appointment of B. H. Tripp as district manager of sales, Pacific Coast territory, succeeding M. W. Priseler.

DALE B. SCARBOROUGH, for the last seven years Pennsylvania representative of the Hygrade Lamp Company, Salem, Mass., on Oct. 1 established himself as Hygrade distributer or jobber in the Pennsylvania district.

LANDERS, FRARY & CLARK, New Britain, Conn., manufacturers of the "Universal" line of electric heating devices, has secured a permit to build an addition to its plant, one-story, 80 ft. by 108 ft.

THE HIGH GRADE LAMP COMPANY, Salem, Mass., announces the appointment of L. H. Pike as factory manager. Mr. Pike has been with the company for about six months as its mechanical engineer and has had many years of training as a manufacturing executive.

WARREN A. PETERS, for many years with the Ames Iron Works, Oswego, N. Y., and recently New England sales manager with office in Boston, has been appointed sales manager of the Star Expansion Bolt Company, New York and Chicago, with factory at Bayonne, N. J.

THOMAS A. EDISON, INC., announces that A. C. Emery, having resigned as general purchasing agent in order to devote his entire time to the Edison International Corporation, William Dykeman has been promoted and will assume the duties of general purchasing agent for the Thomas A. Edison industries.

THE EDISON LAMP WORKS OF THE GENERAL ELECTRIC COMPANY have leased the Sandusky (Ohio) plant of the Libbey Glass Company. This plant manufactures incandescent-lamp bulbs at the rate, it is reported, of 175,000 per day. For some time the entire output of this plant has been furnished to the Edison works.

THE K. C. ELECTRICAL CONSTRUCTION COMPANY, Kansas City, Mo., has bought the storage-battery and starter business of Hayes & Murrill, retaining L. O. Hayes and F. E. Murrill for this department. The company will move by Nov. 1 to 1409-11 McGee Street. It is agent for the General battery and handles also the Ever Ready.

STEVENS & ROCKWELL, consulting engineers, Seattle, Wash., announce the dissolution of the firm. Henry R. Stevens has become electrical engineer for the Stone & Webster Engineering Corporation, Seattle Division. Robert L. Rockwell will continue in consultation work at Suite 955 Empire Building, taking over the organization and equipment of the firm.

GEORGE McD. JOHNS, formerly chief electrical engineer of the city of St. Louis, in charge of the fire and police telephone and telegraph system, has joined the organization of W. N. Matthews & Brother, Inc., in the capacity of production manager. He is now for the third successive term secretary and treasurer of the St. Louis Jovian League of Electrical Interests.

THOMPSON & CASTLETON, INC., electrical dealers, Seattle, Wash., have recently been organized and opened for business with offices and shops at 316 First Avenue South. The company handles electrical, mining and hydraulic machinery, also buys, sells and exchanges new and used machinery.

B. NORDRUP of the firm of Aage Havermanns Ests., Copenhagen, Denmark, has recently arrived in this country on a buying trip and is ready to place orders and make agency arrangements with American manufacturers for representation in the Scandinavian countries for all kinds of electrical supplies. For the next few months he will be at Apartment 34, 2102 Broadway, New York City.

THE MOHAWK ELECTRICAL SUPPLY COMPANY, Syracuse, N. Y., is distributing the *Mohawk News Service*, a monthly bulletin, to customers in an effort to place its business on as near a war basis as possible. The best utilization of electrical supplies in accordance with rulings from Washington appears to be the theme of the bulletin. In the current issue considerable emphasis is placed on good lighting.

THE PETTINGELL-ANDREWS COMPANY, Boston, on Oct. 14 issued War Bulletin No. 4, containing the latest ruling of Priorities Commissioner Edwin B. Parker, relative to the pledging of all dealers, contractors, retailers, repairmen and others buying electrical goods for resale, and also the rules and regulations governing priority in production as authorized by the War Industries Board. The bulletin contains a compact and convenient compilation of priority classifications and their explanation and in a note to the trade sets forth the necessity of accompanying orders with affidavits of priority data in purchasing iron conduit and steel fittings. This house, in accordance with its pledge to the Priorities Division of the War Industries Board, cannot accept at present any orders for iron conduit unless accompanied by affidavit showing automatic rating of B-2 or higher, or covered by priority certificate. On all steel fittings, such as conduletes, V. V. fittings, iron boxes, etc., in the fabrication of which steel is principally used, the company requires the government order number, affidavit covering automatic rating or priority certificate. Such orders will be filled in exact accordance with the rank of the automatic rating or priority certificate, and orders received from industrial plants where only the government order numbers covering materials in process are given cannot be sure of prompt shipment.

MILLIKEN BROTHERS MANUFACTURING COMPANY, INC., New York City, has been organized to succeed Milliken Brothers, Inc., established 1857, taking over certain assets, including patent rights, good will, etc., of the former company. The new company will specialize in the manufacture of galvanized-steel transmission towers. Milliken transmission towers for high-tension power systems have long been a feature of the extensive business of the former organization. More than 40,000 Milliken towers, embracing approximately 4000 miles of transmission system, have been constructed in all parts of the country for such power companies as the Southern Power Company, North and South Carolina; Utah Power & Light Company, Utah and Idaho; Great Western Power Company, California; Portland Railway, Light & Power Company, Oregon; Columbus Power Company, Georgia; Great Falls Power Company, Montana; Pacific Light & Power Company (recently merged with the Southern California Edison Company), California. The new organization will also manufacture galvanized-steel wireless towers, special steel poles for distributing and interurban railway lines, as well as the standardized truss unit system, a patented system of construction for steel buildings, designed by J. E. Jennings, vice-president and secretary of the company and for many years in charge of the power transmission department of the former company. C. T. Clack, for many years connected with the United States Steel Corporation, is president of the company, and Robert Grant, iron and steel merchant, is treasurer. General offices will be in the Woolworth Building.

THE BOSTON WOVEN HOSE & RUBBER COMPANY at the annual meeting held at the executive offices at Cambridge, Mass., on Oct. 7, elected George E. Hall, formerly vice-president and general manager of the company, president and general manager, succeeding Henry B. Sprague, treasurer, who served as president during a portion of the year pending the annual election. Mr. Sprague continues as treasurer and assumes the additional duties of vice-president. Mr. Hall has been associated with the Boston Woven Hose & Rubber Company for eleven years, taking charge as general manager in July, 1907, at which time the company's annual volume of business averaged only about $2,000,000 and its plant at East Cambridge, Mass. comprised only three comparatively small buildings. The fiscal year just completed on Sept. 1 has been the largest in the company's history, the sales totaling well over $10,000,000. The plant, now entirely composed of modern reinforced-concrete buildings, includes a total of more than 20 acres of floor space, being recognized as one of the

GEORGE E. HALL

largest and best equipped plants, if not indeed the very largest, in the world devoted exclusively to the manufacture of mechanical rubber goods. Mr. Hall's election to the presidency comes as a fitting tribute to the irrepressible energy and enthusiasm with which he has led his organization in the upbuilding, of a business which may easily rank as one of New England's leading industries.

Trade Publications

UNDERFEED STOKERS.—Illustrations giving a good idea of the operation of Riley underfeed stokers may be found in publication No. 31 of the Sanford Riley Stoker Company, Worcester, Mass. The advantages of these stokers are set forth.

INDUSTRIAL TRUCK TRAILERS.—Rugged trailers for use with electric industrial tractors are illustrated and described in a bulletin, No. 330, being distributed by the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, Ohio.

MAGNETIC TESTING APPARATUS.—Herman A. Holz, Metropolitan Tower, New York, has issued a booklet entitled "Magnetic Testing Apparatus," setting forth the usefulness of the Fahy permeameter and the magnet meter for the determination of magnetic properties.

WIRING DEVICES.—A catalog of wiring accessories for both inside and outside construction, showing sizes, prices and discounts, may be obtained from the Julius Andrae & Sons Company, Milwaukee, Wis. This catalog also lists some domestic appliances.

MOTOR-DRIVEN SIGNAL CONTROLLERS.—A four-page pamphlet from the Reynolds Electric Company, 422 South Talman Avenue, Chicago, describes motor-driven controllers for the operation of a great variety of automatic light and sound signals such as fire alarms.

METER-READING DEVICE.—A leaflet is being distributed by the Economy Appliance Company, Waterloo, Iowa, illustrating an attachment for a watt-hour meter which permits taking a record of the reading at any time. The applications and method of using this device are explained in the leaflet.

HOUSEHOLD APPLIANCES.—A booklet from the J. B. Terry Company, Cedar Rapids, Iowa, illustrates various domestic electric appliances, giving the advantages of the various devices illustrated.

LAMP GUARD.—W. N. Matthews & Brother, St. Louis, Mo., have issued a folder describing guards for incandescent lamps and an adjustable device for attaching fixtures to conduit in any position desired.

OZONIZED WATER.—In a booklet entitled "The Water Problem Solved," being issued by the Ozone Company of America, Milwaukee, Wis., may be found an account of apparatus by means of which drinking water is treated. Hygienic advantages of water thus treated are also set forth.

FUSE AND DISCONNECTING SWITCH.—A leaflet issued by the Fisher-Chase Manufacturing Company, Columbus, Ohio, shows a cartidge fuse mounted in a box with a handle attached so that the fuse may be operated as a disconnecting switch. There is also an indicating device to show whether the fuse has been blown.

GRAPHITE LUBRICATION.—A treatise on the use of graphite as a lubricant is contained in General Catalog No. 20 published by the United States Graphite Company, Saginaw, Mich. The various forms in which graphite is made up for lubricating purposes are described, and the usefulness of each type is explained.

AUTOMATIC BATTERY-CHARGING DEVICES.—Bulletins 329 and 331 have been received from the Automatic Electrical Devices Company, Cincinnati, Ohio. These bulletins describe battery panels equipped for charging Edison and lead cells, giving detailed descriptions of auxiliary devices such as the chargometer, ammeter and voltmeter switches, indicating lamps and automatic control switches.

MOTION PICTURE PROJECTORS.—The Argus Lamp & Appliance Company, 815 Prospect Avenue, Cleveland, Ohio, is sending out Catalog A-1, dated Sept. 1, 1918, advocating the use of incandescent lamps for motion-picture machines and showing how the incandescent-lamp apparatus may readily be adapted to carbon-arc motion-picture projectors already in use. Necessary accessories for motion-picture projection machines are handled by this company.

New Incorporations

THE CITIZENS' UTILITIES COMPANY of Durand, Ill., has been incorporated with a capital stock of $5,000 by Henry Graham, W. E. Johnson and others.

THE WOODSTON (KAN.) LIGHT & POWER COMPANY has been chartered with a capital stock of $10,000 by Frank Shutts, Fred Shutts and E. C. Parmer.

THE FARMERS' ELECTRIC LIGHT COMPANY of Aberdeen, S. D., has been incorporated with a capital stock of $25,000. Fred P. Tosch is interested in the project.

THE ELECTRIC ANNEALING & MACHINE COMPANY of Bakersfield, Cal., has been incorporated with a capital stock of $30,000 by W. W. Miller, H. E. Edington and Paul McCracken.

THE PALM UTILITIES COMPANY of Palm Beach, Fla., has been incorporated with a capital stock of $50,000. The officers are: A. Blair Ridington, president and treasurer; George A. Lowry, vice-president and F. L. Ridington, secretary.

THE SIMPLEX FARM & PUMP COMPANY of Atlanta, Ga., has been incorporated with a capital stock of $50,000 to install isolated electric lighting and pumping plants. The incorporators are Rollin W. Hutchinson, Jr., Egbert Allen and others.

THE PAGE BATTERY COMPANY of Springfield, Mo., has been incorporated by F. C. Page and Warren L. White. The company is capitalized at $5,000 and proposes to deal in, repair and charge electric batteries; also to buy and sell automobiles and other vehicles.

THE STRAIGHT LINE REGULATOR CORPORATION of New York, has been incorporated by J. Rawls, 715 West 170th Street; W. Asbury, 1105 Amsterdam Avenue, and G. W. Dunn, 261 Broadway, New York City. The company is capitalized at $50,000 and proposes to manufacture motors, engines, machinery, cars, vehicles, etc.

New England States

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 for extension and alteration to machine-shop building No. 42, at the local yard, to cost approximately $770,000. (Specification 3318.) Bids received Sept. 3 were rejected.

BOSTON, MASS.—Bids will be received by the Commission on Waterways and Public Lands, Room 473, State House, Boston, Mass., until Oct. 28 for furnishing and installing one large size and six smaller electrically driven capstans, complete with motors and all operating apparatus, at the capstan pits constructed adjacent to the dry dock by the Commonwealth. Frank W. Hodgdon is engineer.

FALL RIVER, MASS.—The Fall River Electric Light Company has been given permission by the committee on non-war construction to proceed with the construction of a new boiler house at the foot of Hathaway Street. The cost is estimated at about $163,500.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 for extension to boiler house at the local navy yard, to cost about $23,000 (Specification 3499).

Middle Atlantic States

ARGYLE, N. Y.—Bonds, it is understood, have been authorized for the installation of a municipal electric light plant in Argyle.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 for elevator for building E at the Brooklyn Navy Yard, to cost about $5,000 (Specification 3484).

FAIRPORT, N. Y.—The Douglas Packing Company is reported to be considering the construction of a power house, 336 ft. by 50 ft., in Fairport.

FULTON, N. Y.—The Fulton Light, Heat & Power Company has applied to the Public Service Commission for permission to issue $361,666 in bonds, the proceeds to be used for improvements to its plant and system. The company contemplates the installation of a 2500-kva. turbo-generator set, two 500-hp. boilers, extension to power station, excavations in the pond for boiler water, etc., at its steam plant on the lower dam, to cost approximately $209,850. Improvements involving an expenditure of about $151,816 are contemplated at the water-power plant.

GENESEO, N. Y.—Bids will be received by Dr. Thomas E. Finegan, deputy commissioner of education, Education Building, Albany, until Oct. 21 for electric work and electric lamps in Practice School, State Normal School, Geneseo. Drawings and specifications may be consulted at the above school, at the New York office of the Department of Architecture, Room 1715 Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

JAY, N. Y.—The Ausable Forks (N. Y.) Electric Company has petitioned the Public Service Commission for permission to operate in the town of Jay and to issue $25,000 in capital stock. The company has made an agreement with the J. J. Rogers Company of Ausable Forks whereby it is to have all available sources of electrical supply and to carry out certain obligations of the Rogers company.

LOCKPORT, N. Y.—Plans are under consideration by the City Council for improvements to the municipal waterworks at North Tonawanda, including the installation of an electrically operated pumping equipment of 3,000,000 gal. capacity.

MARTINSBURG, N. Y.—The Northern New York Utilities, Inc., of Watertown has petitioned the Public Service Commission for permission to erect an electric transmission line from Lowville to Martinsburg to supply electricity in the latter town. The company was granted a franchise here in April, 1917.

NEW YORK, N. Y.—No bids were submitted on Oct. 2 for installing an extra set of 2300-volt busbars and replacing the existing set; also installing additional panels, switches, bus work, etc., in connection with changes on the 2300-volt switchboard and changes in gallery in substation on Blackwell's Island. The cost is estimated at $10,000. New bids will be asked for. N. B. Lewis, Municipal Building, is engineer.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Republic Carbon Company for the construction of four factory buildings at its local plant, consisting of three one-story structures, one 80 ft. by 340 ft., one 90 ft. by 144 ft., one 48 ft. by 100 ft. and a four-story building 32 ft. by 80 ft. A. D. Smith, Ellicott Square Building, Buffalo, is chief engineer.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NIAGARA FALLS, N. Y.—Plans for the proposed merger of the Hydraulic Power Company and the Niagara Falls Power Company of Niagara Falls have been approved by the Public Service District. The plans of the combined organization call for the immediate construction of a hydroelectric generating plant in the Niagara Gorge, to cost about $16,000,000. The initial installation will consist of two 33,000-hp. generating units. With the proposed construction of diversion channels for water it is proposed to increase the generating capacity of the two companies from 255,000 hp. to 400,000 hp. The new company will be capitalized at $66,000,000 and will be known as the Niagara Falls Power Company. Paul A. Schoellkopf will be vice-president and general manager.

ROCHESTER, N. Y.—Bids will be received by John S. Maxwell, president of board of trustees, New York State Soldiers and Sailors' Home, Bath, until Oct. 23, for construction, including heating, sanitary and electrical work, of barracks H and I at the New York State Soldiers and Sailors' Home. Drawings and specifications may be consulted at the above home, the New York office of the Department of Architecture, Room 1715 Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

SYRACUSE, N. Y.—Bids, it is reported, are being received by Gaggin & Gaggin, architects, University Block, for construction of an addition, 40 ft. by 60 ft., to the power house on Wolf and Seventh Streets of the Crouse-Hinds Company, 1910 Park Street, to cost about $30,000.

GLOUCESTER, N. J.—The Common Council has granted the Emergency Fleet Corporation a franchise to construct and operate a double-track electric traction system in various portions of the city to provide additional transportation for the workers engaged in the various shipbuilding plants and other war plants in this section.

PERTH AMBOY, N. J.—Plans are being considered by the Water Board Commissioners for extensions and improvements to the pumping station at Runyon. The cost of the proposed work is estimated at $60,000 and will include the installation of two pumping units, engines and auxiliary equipment. S. J. Mason is superintendent.

RIVERSIDE, N. J.—The William F. Taubel Company is considering the erection of a boiler plant, 25 ft. by 90 ft., at its hosiery manufacturing plant. The cost is estimated at $10,000.

HARRISBURG, PA.—Arrangements are being made by the Public Service Commission for stock and bond issues for the different light and power companies to provide for extensions and improvements as follows: Jefferson Electric Company of Punxsutawney, $50,000 in stock; Penn Central Light & Transmission Company of Altoona, $82,000 in bonds; Penn Central Light & Power Company of Altoona, $125,000 in bonds; Kane (Pa.) Electric Light & Power Company, $100,000 in bonds and $254,712 in stock; Penn Electric Service Company of Johnstown, $500,000 in bonds; Topton (Pa.) Electric Light & Power Company, $50,000 in bonds; Lycoming Edison Company of Williamsport, $67,500 in notes; Pennsylvania Water & Power Company of Holtwood, $400,000 in bonds; Citizens' Light, Heat & Power Company of Johnstown, $700,000 in bonds; Penn Public Service Company of Philadelphia, $139,000 in bonds; Susquehanna Transmission Company of Holtwood, $32,000 in bonds; Philadelphia Suburban Gas & Electric Company of Philadelphia, $27,000 in bonds; Duquesne Light Company of Pittsburgh, $15,000,000 in bonds and $10,000,000 in notes; Williamsburg Electric Company of Huntingdon, $30,000 in bonds; Lehigh Valley Transit Company of Allentown, $185,000 in bonds, and the Boyertown, Pa., Electric Company, $20,000 in bonds.

LEWISTOWN, PA.—Ground has been broken by the Susquehanna Silk Company for the erection of a new one-story power house, 50 ft. by 100 ft., at its plant.

NOXEN, PA.—A new boiler plant will be erected at the new tanning plant of Armour & Company, to cost about $50,000. The new tannery will replace the plant recently destroyed by fire, and will cost about $1,000,000. Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., are engineers.

PHILADELPHIA, PA.—The William Cramp & Son Ship & Engine Building Company, Beach and Ball Streets, is considering the construction of a two-story engine plant, 305 ft. by 400 ft., at its works, to cost about $100,000.

PHILADELPHIA, PA.—The Philadelphia Quartz Company, 121 South Third Street, has acquired a site of about 30 acres on the Pennsylvania Railroad near Rahway, N. J., for a new plant. The cost of the proposed plant, including housing development for employees, it is reported, is estimated at about $1,000,000.

PHILADELPHIA, PA.—The War Department has authorized additions to the plant of the Hero Manufacturing Company, Gaul and Adams Streets, including three buildings, each about 200 ft. wide, the lengths not decided upon, and a boiler plant, 30 ft. by 30 ft. The cost is estimated at $150,000. The company manufactures brass, bronze and aluminum products.

PITTSBURGH, PA.—Plans are being considered by the Ward & Mackey Biscuit Company for the erection of a bakery on Penn Avenue, near Lexington Avenue, to cost about $125,000.

PITTSBURGH, PA.—Zantzinger, Borie & Medley, architects, of Philadelphia, have been engaged by the United States government to prepare plans and take charge of the housing project on Neville Island, near Pittsburgh. The island is to be the home of workers in the government ordnance plant which is to be erected on the island and will employ from 20,000 to 25,000 men. The plans call for the construction of 15,000 dwellings. The cost of the entire project is estimated at about $50,000,000.

PITTSBURGH, PA.—Preparations are being made by the Duquesne Light Company of Pittsburgh for the construction of an electric generating plant at Cheswick to develop not less than 120,000 kw. The cost of the proposed plant is estimated at between $16,000,000 and $18,000,000, of which amount between 30 and 40 per cent will be contributed from federal funds. The Duquesne Light Company owns the mines of the Equitable Coal Company at Cheswick, which produce 2000 tons daily. An overhead trestle will be erected to carry coal from the mine to the power plant. Work will begin on construction of the plant at once.

WILKES-BARRE, PA.—Plans are being prepared by the Vulcan Iron Works, Main Street, for the erection of a power plant.

BALTIMORE, MD.—The United Railways & Electric Company has awarded contract for the construction of a service station at Carroll and Monroe Streets to the Singer-Pentz Company, Continental Building, Baltimore.

CLAY, W. VA.—Plans are being prepared by O. L. Hall, engineer, Clay, for the erection of an electric transmission line from the plant of the Hartford Power Company at Hartland to Clay, a distance of 5 miles, to supply electricity for illuminating purposes. The cost is estimated at about $10,000.

WHEELING, W. VA.—The United States government has taken over the control of the Manufacturers' Light & Heat Company, which supplies fuel to West Virginia, western Pennsylvania and eastern Ohio cities. The company is capitalized at $50,000,000.

NORFOLK, VA.—The Virginia Railway & Power Company is reported to be considering the installation of two boiler units in its power plant.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 under Specification 3483 for elevators for laundry and power house, to cost about $5,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for furnishing and installing lighting fixtures in the United States Treasury Annex at Washington. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6422¼, refrigerating outfit; Schedule 6448¼, 23,250 pairs searchlight carbons; Schedule 6454¼, 500 battery-charging panels; Schedule 6474¼, binding

wire for turbines and blading material. Eastern and Western yards, Schedule 6425½, 15,000 lb. insulating tape, conduit, cord and cable; Schedule 6465½, 42 circuit breakers. Eastern yards, Schedule 6436½, telephone switchboards. New York, Schedule 6448½, 1000 radio masts. Washington, Schedule 6453½, sheet brass, magnetic sets and magnet cases; Schedule 6471½, one motor-generator set; Schedule 6497½, four traveling cranes. Brooklyn and Detroit, Schedule 6456½, 224 lenses for signal system. Charleston, Schedule 6476½, ammeters, bells, electrical material and wire rope thimbles. Mare Island, Schedule 6477½, 23,500 flashlight batteries. Applications for proposals should designate the schedule desired by number.

North Central States

DETROIT, MICH.—General contract for the construction of a power house for the Murphy Iron Works at the foot of Walker Street has been awarded to the Cooper & Widermann Company.

DETROIT, MICH.—The Central Forge Company of Detroit is planning to erect three one-story factory buildings, 96 ft. by 192 ft., 60 ft. by 301 ft. and 63 ft. by 301 ft. respectively, on Euclid Avenue, to cost about $300,000.

AKRON, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 7 for extensions to conduit and wiring, lighting fixtures, etc., in the United States post office at Akron. For details see Searchlight Section.

CLEVELAND, OHIO.—The Cleveland Electric Metal Company, 2391 West Thirty-eighth Street, is contemplating the construction of a new building, to cost about $50,000.

CLEVELAND, OHIO.—The construction of a new factory, 80 ft. by 400 ft., one story high, is reported to be under consideration by the Electric Steel Forge Company.

CLEVELAND, OHIO.—Bids, it is reported, will soon be asked by the Bissinger Magneto Company, 1613 Prospect Avenue, for construction of a new factory on East Twenty-first Street, to cost about $50,000. S. H. Weiss, Schofield Building, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 219 City Hall, Cleveland, until Oct. 24 for construction of a garage for the division of water at St. Clair Avenue and East Third Street, as follows: (1) General contract; (2) heating; (3) plumbing; (4) electrical equipment. Specifications may be obtained at the office of the city architect, 604 City Hall.

DAYTON, OHIO.—Additional equipment is being installed in the plant of the Dayton Electrical Manufacturing Company on Fourth Street.

SALEM, OHIO.—Bonds to the amount of $15,000 have been issued by the city of Salem for equipping the waterworks pumping station for electrical operation. The proposed improvement includes the installation of a large triplex pump, three deep-well pumps and a small motor-driven compressor.

SANDUSKY, OHIO.—Work has begun on the installation of new Riley stokers in the power house of the Sandusky Gas & Electric Company.

SMITH'S GROVE, KY.—The capital stock of the Smith's Grove Light & Ice Company has been increased from $5,000 to $10,000, the proceeds, it is understood, to be used for extensions.

INDIANAPOLIS, IND.—The Ross Power Company of Indianapolis, it is reported, would like to receive prices on a 100-200-kw., 240-480-volt, 60-cycle, three-phase engine-driven generating set; 500-1000-gal. per minute boiler-feed pump; one 100-kw., 175-volt turbine, non-conductor exciter unit; one 100-80-hp. gas engine, belted, and two 500-hp. boilers.

CHICAGO, ILL.—Plans are being prepared by William P. Whitney, architect, South Dearborn Street, Chicago, for a manufacturing plant to be erected at Clearing, Ill., which will include a machine shop, 100 ft. by 210 ft., and a one-story foundry, with provision for a traveling crane in the future. The cost is estimated at $96,000. The name of the owner is not made public.

KEMPTON, ILL.—Plans are being considered for the purchase of a municipal electric light plant for which bonds have been voted.

RED BUD, ILL.—The City Council has purchased the electric equipment, consisting of an engine, generator, switchboard, etc., which has been in operation at Washington, Mo., for the municipal electric light plant.

BEAVER DAM, WIS.—The Western Malleable Company of Beaver Dam expects to install electrical equipment, consisting of one 300-kva., 2300-volt, 60-cycle, 240-volt, direct-current, and one 200-kva., 2300-volt, 60-cycle, 240-volt direct-current synchronous motor-generator, with switchboard and control apparatus, in its plant in the near future. L. S. Weiner, electrical engineer, will have charge of the installation.

MILWAUKEE, WIS.—Plans are being considered by the Allen-Bradley Company, Greenfield Avenue and Clinton Street, Milwaukee, for the erection of an addition, 65 ft. by 90 ft., at its plant, to cost about $35,000. The company manufactures electric controlling apparatus. Alexander C. Eschweiler, Goldsmith Building, is architect.

UNION GROVE, WIS.—The Electropure Dairy Company of Burlington is contemplating the construction of a milk-condensing plant in Union Grove, to cost about $30,000. It will be equipped with electrically operated machinery.

ST. LOUIS, MO.—The Dielectric Manufacturing Company, 224 South Vandeventer Avenue, St. Louis, it is reported, is contemplating the purchase of electric motors and rubber-compounding machinery. J. J. Kessler is president.

ST. LOUIS, MO.—Contracts have been awarded for the erection of two steel-manufacturing plants in connection with the plants of the Laclede Gas Light Company in St. Louis to the Austin Company of Cleveland, Ohio. The cost is estimated at $3,830,300.

ST. LOUIS, MO.—Plans, it is reported, have been prepared by G. P. Wuest, Wainwright Building, St. Louis, for the construction of a laboratory and administration building, 60 ft. by 100 ft., for the Pan.-Electric Manufacturing Company, 735 South Fourth Street. W. B. Botts of St. Louis is contractor. The cost is estimated at $50,000.

SIOUX FALLS, S. D.—A petition has been filed with the City Council asking that the proposal to issue $300,000 in bonds for the construction of a new municipal electric light plant be submitted to the voters. The petition states that for the present the city could use the present lighting system to furnish service in the downtown district if the water were pumped by steam instead of electricity.

KIRWIN, KAN.—The City Council has entered into a contract with the Phillipsburg (Kan.) Mill & Elevator Company to furnish electricity in Kirwin.

Southern States

GADSDEN, ALA.—The National Pipe & Foundry Company is planning to rebuild its machine shop, steam-fitting shop, pipe-fitting department and warehouse, recently destroyed by fire, causing a loss of about $100,000.

GENTRY, ARK.—The local electric light plant, it is reported, was recently destroyed by fire.

HOWE, OKLA.—At an election held recently bonds to the amount of $5,000 were voted for the installation of a municipal electric light plant.

KIEFFER, OKLA.—The high-tension transmission line of the Oklahoma Gas & Electric Company connecting the systems of Sapula and Kiefer has been completed. The local electric generating plant will be dismantled.

TULSA, OKLA.—The Atchison, Topeka & Santa Fé Railway Company is reported to have awarded contract for the construction of a passenger depot, freight station and terminal yards at First and Second Streets from Elgin to Grove Avenue, to cost about $2,000,000. The terminal yards will have about 10 miles of trackage and an electrical interlocking system will be installed. H. W. Wagner of Topeka, Kan., is chief engineer.

McKINNEY, TEX.—The Texas Electric Railway Company of Dallas has purchased a site between Kentucky and Tennessee Streets on which it expects to erect an express terminal and build extensive trackage to take care of its increasing express and freight business. The cost is estimated at about $25,000.

Pacific and Mountain States

EVERETT, WASH.—The Pacific Coast branch of the Fordson Tractor Company, it is announced, will be located in Everett. About 8000 people will be employed at the proposed plant.

SEATTLE, WASH.—The Standard Electric Company of Seattle has secured the contract to install the electrical equipment in the large mills of the Puget Mill Company at Hoods Canal. The equipment will include a 1000-kw. turbine, two 300-hp. motors for the headsaws in two of the mills, and over 70 motors varying in size from 3 hp. up. The entire plant will be wired for an electric lighting system and a new alternating-current system installed for lighting the town of Port Gamble. The motors and turbines were purchased from the Allis-Chalmers Company. The company is also installing an entirely new lighting system in the machine shops of the Washington Iron Works. About twenty motors will be rewired, a conduit system installed, in addition to a new alternator and switchboard.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Service Commissioners, Room 1002 Knickerbocker Building, Los Angeles, until Oct. 25 for furnishing the Department of Public Service with 33,000-volt and 1100-volt oil switches in accordance with Specification No. P-181. Howard Robertson is president of board.

NEWPORT, CAL.—The City Council is planning to install an electrically operated pumping plant in connection with the proposed new sewerage system, to cost about $172,370.

OROVILLE CAL. — Plans are being considered by the Pacific Gas & Electric Company for increasing the capacity of its hydroelectric plant at Oroville.

SAN DIEGO, CAL.—Plans have been completed by the San Diego & Arizona Railroad Company for the erection of new locomotive and car repair shops in the vicinity of Sixteenth Street and Newton Avenue. A new engine will also be built.

BUTTE, MONT.—The Butte Electric Railway Company is double-tracking its system in the city of Butte, at a cost of about $86,000. J. R. Wharton is manager.

CHOTEAU, MONT.—The Montana Power Company is erecting a high-tension transmission line (50,000 volts) from Choteau to Conrad, a distance of 32 miles. The cost of the line is estimated at about $50,000.

LEWISTON, MONT.—The Cook County Transit Company, it is reported, is preparing plans for the construction of an electric railway from a point near Gardiner along the Yellowstone River to the Lamar River and Soda Butte Creek. Richard Zahniser of Livingston is secretary.

Canada

GRANBY, B. C.—Preparations are being made for the installation of an electric lighting system in the new town of Granby, near Cassidy's Siding. An air shaft has been completed preparatory to installing a permanent air fan.

NEW WESTMINSTER, B. C.—The Lumber Products, Brunette Street, is considering building an addition to its plant and installing new machinery, at a cost of about $120,000.

VANCOUVER, B. C.—The Tudhope Electric Metals Company is contemplating the construction of a new foundry, 50 ft. by 100 ft.

DALHOUSIE, N. B.—The Dalhousie Lumber Company is contemplating the construction of an addition to its mill. New equipment, including steam engines, boilers, sprinklers, feed pump, motors, etc., will be required.

GALT, ONT.—Plans are being considered by the City Council for extensions to the municipal electric-light plant, to cost about $25,000. W. H. Fairchild is engineer.

TORONTO, ONT.—The Ontario municipalities connected with the Hydro-Power Union, it is stated, will soon hold a meeting to consider the question of establishing a telephone system in those districts served by the Ontario Hydro-Power Union.

UNIONVILLE, ONT.—The ratepayers of Unionville are considering securing an extension of the Hydro-Electric system from Agincourt to Unionville, a distance of 5 miles. The plans provide for the installation of 35 street lamps. The cost of the project is estimated at $10,000.

ESTEVAN, SASK.—The Estevan Board of Trade has been reorganized under the name of the Estevan Chamber of Commerce for the purpose of interesting similar organizations in a coöperative power scheme. It is proposed to develop either gas or electricity from the vast lignite coal deposits at Estevan and transmit it to the Soo line towns and the cities of Moose Jaw and Regina.

1,278,266. TIRE-WRAPPING MACHINE; Park E. Welton, Cuyahoga Falls, Ohio. App. filed April 5, 1915. Spirally wraps narrow strip of paper or fabric around pneumatic-tire casing.

1,278,282. TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill., and Harry E. Hershey, White Water, Kan. App. filed Dec. 5, 1913. For operating measured service devices or supervisory signals in automatic or semi-automatic systems.

1,278,308. MANUFACTURE OF SULPHURIC ACID; Joseph F. Cullen, Midvale, Utah. App. filed Sept. 13, 1917. Sulphur dioxide utilized in treatment of manganese and zinc ores.

1,278,322. INCLOSED SAFETY FUSE; Alfred L. Eustice and John B. Griffith, Chicago, Ill. App. filed Aug. 2, 1915. Relates to knife-blade cartridge fuses of non-renewable type.

1,278,324. TYPEWRITING MACHINE; Hubert P. Fraenzl, Tacoma, Wash. App. filed Oct. 1, 1917. For shifting carriage of typewriter and operating or turning platen.

1,278,330. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Dec. 2, 1916. For notifying subscriber whose line has been found busy that another subscriber is awaiting connection with his line.

1,278,331. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Sept. 17, 1917. Circuit arrangements for selector switches employed in automatic or semi-automatic telephone exchanges.

1,278,339. PLUG SOCKET AND FUSE BOX; Harold P. Hastings and Floyd C. Smith, Syracuse, N. Y. App. filed Aug. 6, 1915. Accessible in simple and efficient manner.

1,278,357. SHELL AND PROJECTILE; Laurence S. Lachman, New York, N. Y. App. filed Dec. 7, 1915. Nose or cap secured by welded rivets or pieces.

1,278,365. AOTOMATIC TELEPHONE SYSTEM; Anders M. Malmberg, Chicago, Ill. App. filed April 27, 1914. Amount of apparatus in the exchange can be greatly reduced.

1,278,368. WELDING CONTROLLER; Theodore D. Montgomery, East Orange, N. J. App. filed April 17, 1916. Holds its automatic switch closed independently of switch-operating windings.

1,278,410. AUTOMOBILE ATTACHMENT; David L. Winters, Philadelphia, Pa. App. filed May 22, 1917. Applied to steering wheels of automobiles for sounding horn or actuating some other signal.

1,278,441. SPARK INTENSIFIER; William J. Cunningham, Toledo, Ohio. App. filed May 28, 1917. Easily and quickly applied to spark plug.

1,278,448. ELECTROMAGNETIC SWITCHING DEVICE OR RELAY; Samuel H. Everett, Brooklyn, N. Y. App. filed March 11, 1915. Operates on direct current alone or on direct current upon which are superimposed alternating currents of widely different frequencies, but will not operate upon any of those alternating currents alone of values experienced in service.

1,278,467. THERMAL CUT-OUT FOR ELECTRICAL CIRCUITS; Henry A. Hoeschen and William G. Hoeschen, Omaha, Neb. App. filed March 21, 1917. Automatically compensates for temperature changes caused by means other than current.

1,278,480. COMPOSITE METAL WORK; Laurence S. Lachman, New York, N. Y. App. filed Feb. 8, 1918. Tube projecting from one face of plate and united therewith by welded union.

1,278,484. ELECTRIC HEATER UNIT; Leslie V. Leonard, Richmond, Victoria, Australia. App. filed Dec. 8, 1917. Radiant and reflected as well as convective heat is concentrated and given off in one direction.

1,278,492. SIGNALING SYSTEM FOR MOTOR VEHICLES; Max A. Miller, Maywood, Ill. App. filed July 23, 1917. For indicating change of direction of movement of vehicle.

1,278,505. TRANSMITTER; Charles A. Reifel, New York, N. Y. App. filed Nov. 10, 1917. Of microphone type, for use in audiphones.

1,278,507. RADIO-TELEGRAPH TRANSMITTING SYSTEM; Oscar C. Roos, Allston, Mass. App. filed July 14, 1917. Discharge of oscillating circuit condenser may be readily controlled over wide tone range.

1,278,508. RADIO-TELEGRAPH TRANSMITTING SYSTEM; Oscar C. Roos, Allston, Mass.

Record of Electrical Patents

Notes on United States Patents

App. filed July 14, 1917. Effect of auxiliary source of electrical energy is augmented by resonance, and interaction between circuit of source and other parts of system is prevented.

1,278,509. BLOCK SIGNAL SYSTEM; John J. Ruddick, Newton, Mass. App. filed March 19, 1913. Plurality of cars may follow each other into the block in same direction without disturbing signals.

1,278,522. OSCILLATING SAFETY SWITCH; Horatio S. Tittle, San Francisco, Cal. App. filed Nov. 16, 1916. For use in starting motors where very heavy starting current is required.

1,278,530. ELECTROTHERMAL ROBE; Howard H. Wallace, Salt Lake City, Utah. App. filed Jan. 23, 1918. Fastened about person to be medically treated with electrically generated heat.

1,278,535. WIRELESS SIGNALING APPARATUS; Roy A. Weagant, Roselle, N. J. App. filed April 5, 1915. For detecting and amplifying electrical impulses or variations.

1,278,610. AUTOMATIC CONTROLLER; Garrett B. Downs, Mauch Chunk, Pa. App. filed March 6, 1915. Causes resistance to be gradually cut down before direct or main line current can pass through driving motors of electric car or other vehicle.

1,278,635. ELECTRIC FURNACE AND METHOD OF SUPPLYING CURRENT THERETO; James H. Gray, New York, N. Y. App. filed July 20, 1918. Prevents excessive surges in fluctuations of current and interruption of arc during melting-down period.

1,278,652. RAILWAY-SIGNALING TRACK INSTRUMENT; Henry A. Hoeschen and Joseph A. Hoeschen, Omaha, Neb. App. filed March 5, 1914. Different electrical circuits may be established in accordance with direction of movement of train along track.

1,278,661. CARBON HOLDER OF ELECTRIC-ARC LAMPS; William L. Humphries, Patricroft, England. App. filed Jan. 19, 1918. Carbon is held near end while clamp supports holder.

1,278,675. ELECTROTHERAPEUTIC APPARATUS; Yoshinao Kawakita, Kamoto-Gun, Kumamoto-Ken, Japan. App. filed Nov. 24, 1916. Current of very high frequency and voltage and second current of low frequency and voltage flow in "operating" circuit at same or different times.

1,278,697. TELEPHONE-EXCHANGE SYSTEM; Albert E. Lundell, New York, N. Y. App. filed Nov. 2, 1917. Small number of auxiliary switches needed to control connections between operator's head set and cords at her position.

1,278,709. SIGNAL SYSTEM; Louis W. Miller, Rochester, N. Y. App. filed Aug. 25, 1915. For police signaling in cities and municipalities.

1,278,723. ELECTROLYTIC CELL; Frank H. Nickle, Midland, Mich. App. filed Aug. 19, 1914. For electrolysis of alkali-metal chloride, particularly sodium and potassium chloride.

1,278,724. ELECTROLYTIC CELL; Frank H. Nickle, Saginaw, Mich. App. filed March 28, 1917. For electrolysis of alkali chloride, production of caustic alkali and chlorine.

1,278,738. SIGNALING DEVICE; Edward G. Petrie, Irvington, N. J. App. filed Jan. 21, 1918. Illuminated hand-signaling device wherein semaphore-like signaling movements of hand and arm are employed.

1,278,757. WINDING MACHINE; Claes Ryden, Cranston, R. I. App. filed June 8, 1914. For disconnecting guide-traversing means from power-driven mechanism of electrical coils.

1,278,770. CONTROLLER FOR DYNAMO-ELECTRIC MACHINES; Arthur Simon, Milwaukee, Wis. App. filed June 5, 1915. For direct-current dynamo having alternating-current stator and rotor whereby it is driven as an induction motor.

1,278,775. ELECTRICAL APPARATUS FOR HEATING LIQUIDS; William H. Smith, Falkirk, England. App. filed Dec. 12, 1916. Surfaces of plugs of heating tube are maintained at a distance apart equivalent to height of column of granules.

1,278,780. ELECTRIC SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed Jan. 11, 1918. Of particular advantage when incorporated in pendent snap switches.

1,278,781. ELECTRIC SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed Jan. 11, 1918. Compact; provides for efficient action of circuit-controlling member.

1,278,815. PANOTOGRAPH TROLLEY; Christian Aalborg, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Adapted to collect large amounts of current under high-speed operation and to be operated in places where lateral space is limited.

1,278,824. ELECTRIC LANTERN; Frank T. Baird, Blue Island, Ill. App. filed Dec. 4, 1918. Uses recharge battery or ordinary dry battery.

1,278,842. MACHINE FOR MARKING SHOE UPPERS; Arthur W. Brice and Irving E. Booth, Rochester, N. Y. App. filed April 19, 1916. Electrically heated cauterizing device places indication marks upon material to designate locations for subsequent operations.

1,278,847. TELEPHONE SIGNAL RELAY; Earl Buker, Butte, Mont. App. filed May 26, 1917. Will not cause a vibratory movement of the contacts of local circuit.

1,278,850. TRAIN-SERVICE COUPLING; Albert J. Campbell, Marion, Iowa. App. filed April 20, 1918. Provides complete electrical circuit by way of the train pipe, instead of depending upon ground connections to complete circuit.

1,278,860. WELDING CONTROLLER; Leonard P. Coulter, Milwaukee, Wis. App. filed May 6, 1915. To provide welding controller having an automatic switch which will not be subjected to the full welding current.

1,278,864. REPEATING COIL; Hiram D. Currier, Chicago, Ill. App. filed April 9, 1914. U-shaped core permits easy mounting of the windings in efficient relation to core.

1,278,865. DYNAMO-ELECTRIC MACHINE; James F. Curtis, Pitcairn, Pa. App. filed April 25, 1914. Integrally combined wiper ring and set of fan blades provided for rotors.

1,278,893. INCLOSED SAFETY FUSE; Alfred L. Eustice, Chicago, Ill. App. filed Aug. 2, 1915. New link cannot be inserted in fuse without destroying parts thereof.

1,278,911. CARTRIDGE FUSE; John B. Griffith, Chicago, Ill. App. filed Aug. 2, 1915. Has end caps to inner faces of which ends of the fusible link of fuse are soldered.

1,278,917. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 10, 1914. Is of remote-control, multiple-unit type and adapted to govern operation of fluid-actuated mechanisms.

1,278,920. FIRE-DETECTING WIRE; Charles Harsch, New York, N. Y. App. filed July 27, 1917. When alloy is heated it is forced outward and perforates the insulating coating, making electrical contact with armor.

1,278,921. ELECTRICAL MEASURING INSTRUMENT; Stephen Q. Hayes, Pittsburgh, Pa. App. filed June 5, 1916. Indicates power factor, power and reactive components of energy and volt-amperes traversing circuits to which they are connected.

1,278,923. SYSTEM AND METHOD OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 7, 1914. For commutator type or similar machines, whereby good commutating and general operating conditions are obtained, particularly during starting period.

1,278,924. MOTOR FOR PULSATING CURRENT; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1916. Of commutator type, particularly designed for operation upon pulsating supply circuits.

1,278,936. CENTRIFUGAL SWITCH; John T. Janette, Chicago, Ill. App. filed June 16, 1917. Used in connection with alternating-current motors for introducing and cutting out split-phase starting coils.

1,278,940. LIQUID-LEVEL GAGE; Leon Le Compte, McKittrick, Cal. App. filed July 27, 1916. Annunciator acts with circuit-completing arrangement to turn indicating member when a circuit is completed.